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Experiences in Machining Aluminum Alloys—I

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Men engaged in aircraft manufacturing have had to do a lot of pioneering in tool design for the strong aluminum alloys. This installment presents the author's ideas on practical tools for turning, shaping, milling, boring and counterboring

ALTHOUGH the use of aluminum alloys is increasing in general manufacture, few people realize the peculiarities encountered in machining these materials. The alloys used considerably in aircraft work and to a great extent in other lines as well are: alloy 17ST, a strong alloy of the dural type, and two casting alloys, 195HT 4, which contains about 4.5 per cent copper as a hardener, and a 13 per cent silicon-aluminum alloy. The latter casting material is used extensively for complex fittings in seaplane hulls.

The materials are listed above in the order of ease of machining. Alloy 17ST is very readily cut, while 195HT 4 cuts easily but is harder on tools. Both materials machine up to a silvery finish, and for cutting them highspeed steel tools of 58C Rockwell hardness are satisfactory. The high-silicon alloy is quite abrasive, has a gray appearance, and requires tools with 62C Rockwell hardness.

Alloy 17ST has the property of growing in dimension when machined. Evidently the degree of internal stressing from the quench is very great, for when slabs are cut up they change remarkably in dimensions. For example, Fig. 1 shows a hinge fitting made from hot-rolled bar 6⅞x3⅝ in. in cross-section, with ¾-in. radius corners, originally about 18 ft. long and received in the heat-treated condition. After cutting to length and face milling the four sides, the slugs indicated were hand-sawed out, whereupon the remaining tines elongated between 0.028 and 0.035 in. consistently, in addition to a general warpage of the fitting. In the first group

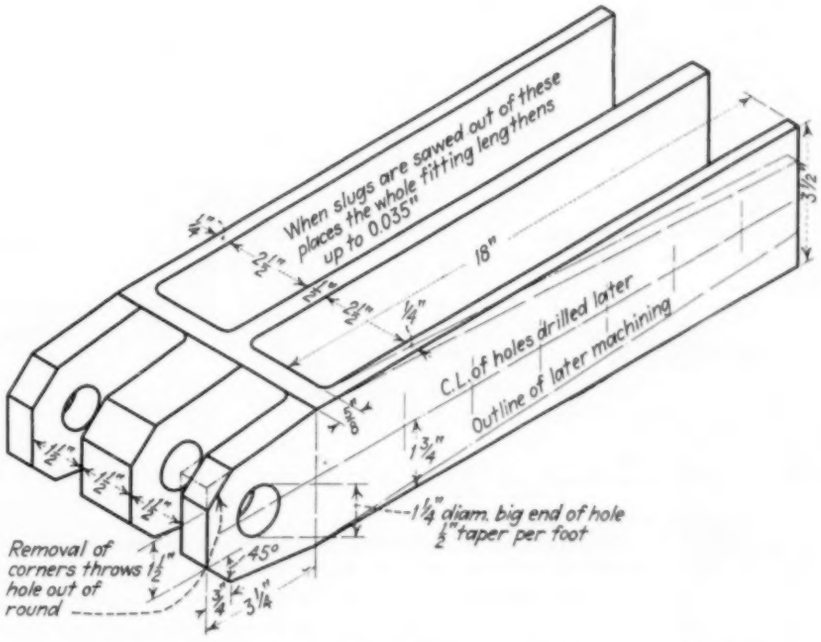
When slugs are sawed out of these places the whole fitting lengthens up to 0.035"
18"
C.L. of holes drilled later
Outline of later machining
1¼" diam. big end of hole
½" taper per foot
Removal of corners throws hole out of round
45°

Fig. 1—Unusual growth during machining can be expected from the aluminum alloys. This 17 ST hinge fitting, made of hot-rolled bar, lengthened and warped generally, requiring care in the sequence of operations

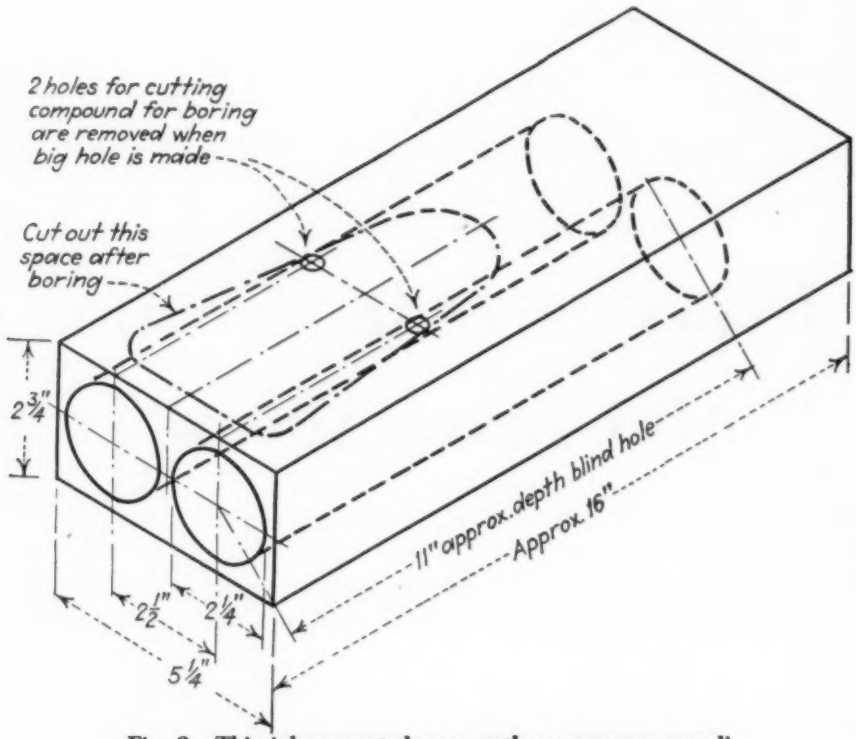
2 holes for cutting compound for boring are removed when big hole is made
Cut out this space after boring
2 3/4"
1"
2 1/2"
2 1/4"
5 1/4"
11" approx. depth blind hole
Approx. 16"

Fig. 2—This job presented no growth or warpage complications, but chips caught between the coolant holes and the tool edges and spoiled the main holes

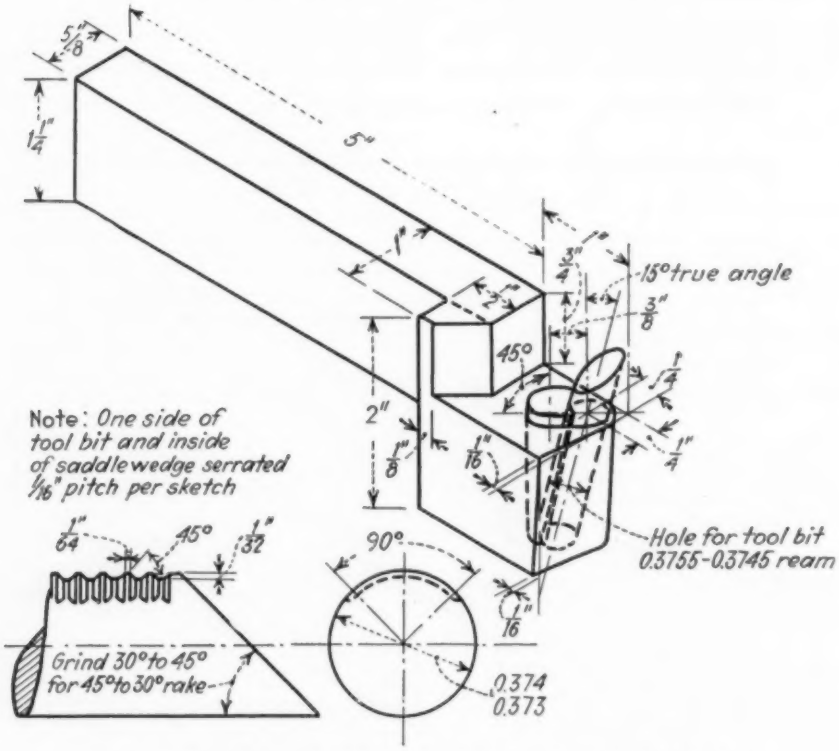

Fig. 3—Serrations in this wedge-lock toolholder permit heavy and intermittent cutting, and besides the toolbit is not weak like an ordinary bit ground for aluminum

of fittings made, the "holes drilled later" were instead drilled first, fortunately 1/32 in. undersize, and it was just possible to clean them up to proper dimension and location. Subsequent fittings were finally drilled after sawing.

Many aircraft sub-assemblies are now connected by tapered bolts. A taper of 1/2 in. per ft. is a satisfactory compromise between sensitivity to fitting, weight loss and stresses due to assembly conditions. With alloy fittings and steel bolts the criterion is bearing strength of the dural, so that accuracy of fit of the conical surfaces is important. Removal of corners as indicated, after holes are finish reamed, is fatal to good bearing. Such holes should be finished last.

In contrast to Fig. 1, Fig. 2 shows another block made from the same kind of raw stock. This part, while ultimately lightened, does not have the outer parts cut away like the first. It is tied together quite well and presents no warpage or growth complications. It is also shown for another reason mentioned later.

In turning, top rakes should be between 30 and 45 deg., the latter for 17ST, the former for the high-silicon alloy. When satisfactory top rake is ground on ordinary toolbits, they are somewhat weakened, particularly since they are loaded in bending. The wedge-locked toolholder, Fig. 3, has the advantage that the tool clearance is fixed, top rake is easily controlled and bending load on the toolbit is minor. A smart rap on the underside or end of the bit loosens it for resharpening by grinding the top surface. The shank is of medium-carbon alloy steel, hardened and drawn to about 330 Brinell, the holes being put in after heat-treatment, which is still possible, though a trifle slow. The wedge is harder. Serrations in the tool are coined in the annealed stock. The serrations make such a tool suitable for heavy and intermittent cutting. Fig. 4 shows an adaptation of Fig. 3 made by substituting a hollow setscrew for the wedge. The toolbit may be twisted to different positions with respect to the shank, but unless the bit is backed up by a bottom stop

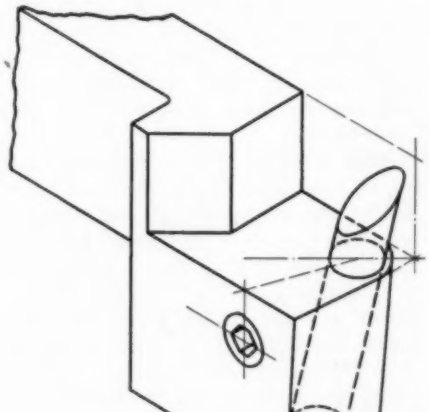

Fig. 4—Cheaper construction than Fig. 3, but not good for intermittent cuts unless backed up with a stop such as a setscrew

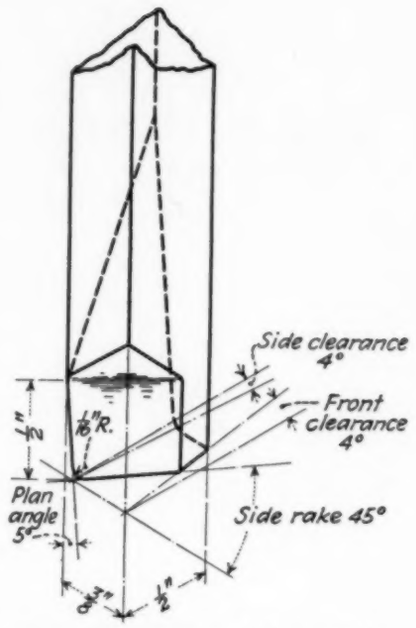

Fig. 5—Shaper tool for use in planer-type toolholder

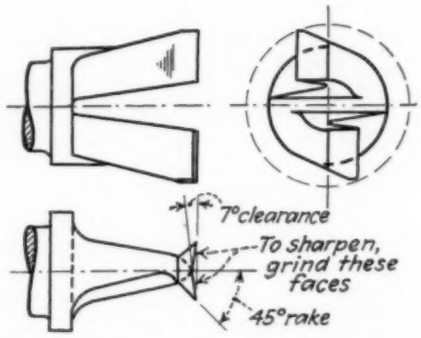

Fig. 8 — A counterbore or stub boring tool can be made from a scrap twist-drill stub

it is not good for intermittent cutting.

Holders made right- or left-handed are satisfactory for shaper work. Fig. 5 shows a tool used for obtaining reasonably good finish at one cut, removing about $\frac{1}{16}$ in. of material at $\frac{1}{16}$ in. feed per stroke. Such a bit is held in Armstrong planer-type toolholders, and the edges are stoned after grinding on the cutter grinder.

In milling, the peripheral clearance should be 7 deg., which is greater than for steel. Ordinary cutters are deficient in rake, and if ground for light alloys are quickly dulled when used on other materials. Fig. 6 shows a suitable face-mill design, with teeth pressed into the machine-steel body. When making cheap tools, there is no necessity to use any other locking means than the press fit. Relatively enormous chip room is mandatory, however, hence the coarse pitch of the teeth.

Fig. 7 shows the toolbit end of the final drill used for boring the 2¼-in. holes of the part shown in Fig. 2. When enlarging the hole from 2 or even 2⅛ in. the chips did not clear. In redesign of the tool it was found that the 10-deg. front rake should be negative instead of positive and that the 20-deg. end rake should be increased to 30 deg. In the part shown in Fig. 2, the holes for lubricant were put in experimentally in an attempt to facilitate supplying cutting compound to the drill end. Actually they were a hazard, chips catching in them and causing scratches in the bores.

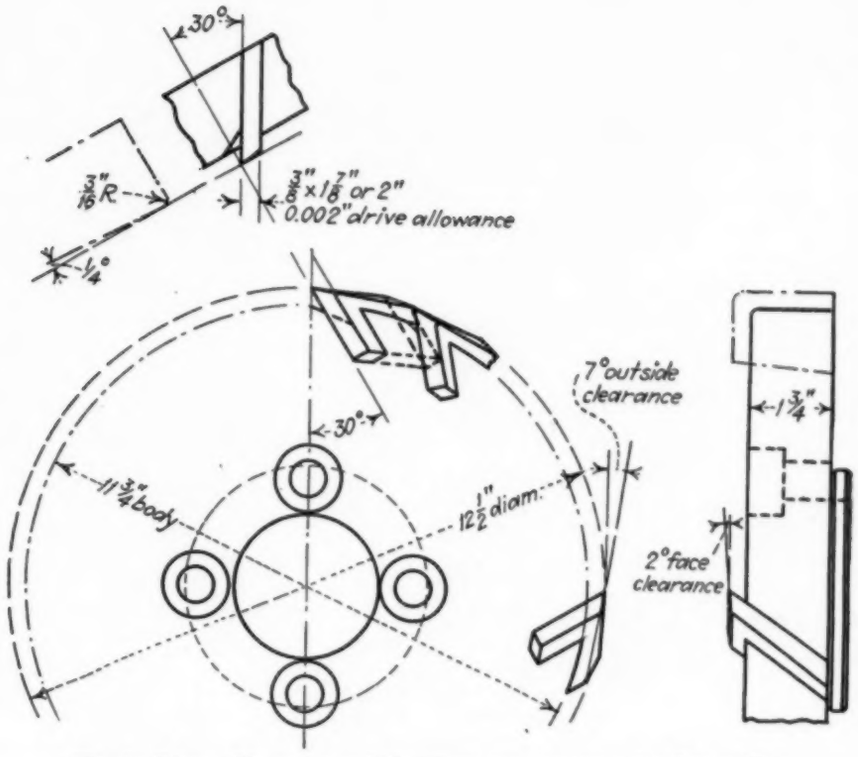

Fig. 6—Large chip room and clearance are necessary for face mills

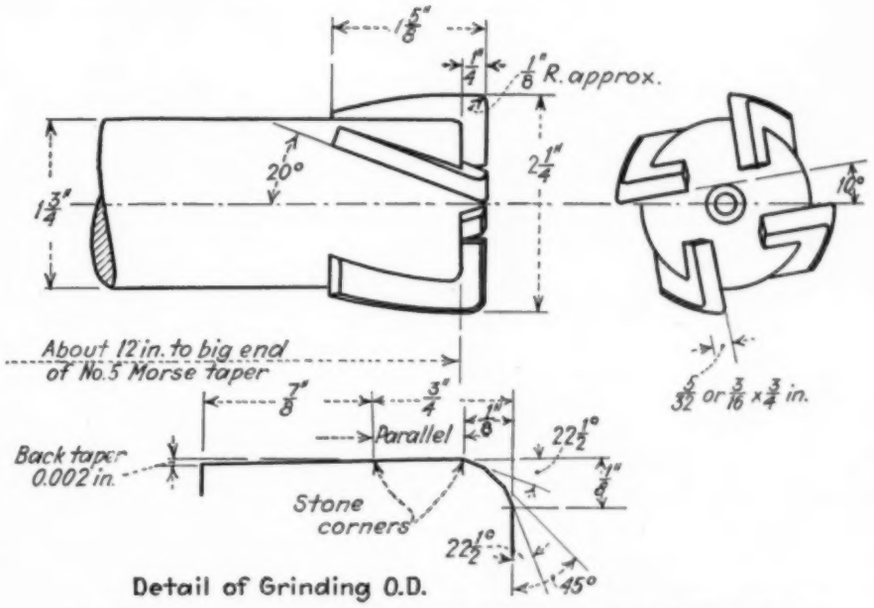

Fig. 7—The main holes, Fig. 2, were brought to size with this tool. Modifications should be made as described in the text

Fig. 8 shows a counterbore, or stub boring tool, made from a scrap twist-drill stub. This is split up the web with a $\frac{1}{16}$-in. abrasive cut-off wheel, forged to shape, rehardened and ground. It definitely meets requirements of rake, clearance and chip room.

(The second part of the article will take up reaming and tapping problems.)

Special Thread Forms and Their Uses

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Too often an expensive special thread is specified when a standard form is really better. But when non-standard threads are desirable they should be chosen with an eye to machining possibilities

THIS article is not intended to condemn standard thread forms but rather to point out some improper uses of special threads which are expensive to produce. This includes the use of full depth threads where modified forms would answer; and using square and buttress threads where a standard thread, or a thread having an included angle, would serve the purpose and at the same time greatly decrease the cost of machining.

When it is necessary to use a special thread, there are several things to consider before specifying the pitch and form, if the thread is to be cut with dies.

1. Will the thread permit free machining with dies?
2. Is it necessary to use a full depth of thread?
3. Is the helix angle excessively high?
4. Will the root diameter of the thread be strong enough to support the torque of the cut?
5. Does the thread permit the use of at least a 20-deg. throat on chasers for U. S. form and 12 deg. for Acme or similar forms?

No. 5 refers to threads which run into an undercut or against a shoulder. In such cases, is it necessary to limit the width of the undercut to ⅛ in. (this appears to be a popular width), or to show the thread cut up to a shoulder?

The Landis Machine Company has furnished chasers for cutting approximately 1500 different types of special threads. One of the common faults, generally found when using the Acme form, is that a standard Acme thread will be specified on a small diameter and the pitch of the thread will be too coarse to be machinable with dies. This makes a slower and more expensive method necessary, such as threading with a single point tool or milling.

For example: Take a screw having a diameter of ¾ in. where a 4-pitch standard Acme thread approximately 12 in. long is specified. The purpose of the screw is to get a lead of ¼ in., and it is not necessary to have thread strength. The root diameter of the screw will be 0.420 in. Therefore, it is not strong enough to withstand the torque of machining the thread in one pass.

One way to obtain a ¼-in. lead would be to use a double thread, ⅛-in. pitch, ¼-in. lead, standard Acme. The root diameter in this case would be greatly increased, and a stronger screw would result. The ¼-in. lead can also be obtained by using ⅛-in. pitch quadruple thread. Still another method would be to use a ¼-in. pitch modified depth of thread.

A 29-deg. thread form, which will often answer for a standard Acme and which offers better machining, is the modified Acme thread shown in Fig. 1. This modified Acme form decreases die and tap breakage because the cutting teeth are stronger than the standard Acme and have less work to do.

On automobile jacks, a modified depth of one-half the standard depth is often used where the jack screw has a tapped hole for the inner screw. This is done to increase the wall thickness.

Using a modified depth greatly increases the strength of the cutting teeth on dies and taps and, therefore, reduces the danger of chipping the teeth and keeps tool cost to a minimum. The purpose of the Acme is to take care of severe side thrust and wear on the thread. This is often misused in designing where a 60-deg. form would answer the purpose.

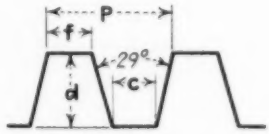


FIG.1

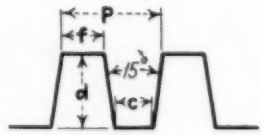


FIG.2

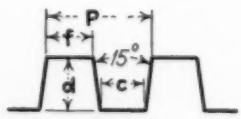


FIG.3

Fig. 1—Modified Acme thread (depth)

FOR SCREWS:
$D = 0.375\,P + 0.010$ in.; $F = 0.40302\,P$; $C = 0.40302P - 0.0052$ in.
FOR TAPS:
$D = 0.375\,P + 0.020$ in.; $F = 0.40302\,P - 0.0052$ in.; $C = 0.40302\,P - 0.0052$ in.
$P = 1 \div$ number threads per in.

Fig. 2—Modified square thread (form)

FOR SCREWS:
$D = 0.500\,P + 0.010$ in.; $F = 0.4342\,P$; $C = 0.4342\,P - 0.0026$ in.
FOR TAPS:
$D = 0.500\,P + 0.020$ in.; $F = 0.4342\,P - 0.0026$ in.; $C = 0.4342\,P - 0.0026$ in.
$P = 1 \div$ number threads per in.

Fig. 3—Modified square thread (form and depth)

FOR SCREWS:
$D = 0.375\,P + 0.010$ in.; $F - 0.4507\,P$; $C = 0.4507\,P - 0.0026$ in.
FOR TAPS:
$D = 0.375\,P + 0.020$ in.; $F = 0.4507\,P - 0.0026$ in.; $C = 0.4507\,P - 0.0026$ in.
$P = 1 \div$ number threads per in.

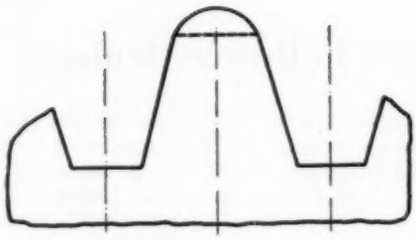


Fig 4—Screws that engage with split nuts are usually improved by the use of a thread form with rounded tops

An Acme thread form is far more expensive and difficult to cut, whether it is on a screw or in a nut.

There appears to be a weakness, when the design requires a coarse pitch thread, for specifying either a square or an Acme form. Screws used for lifting car windows, moving seats, and takeup screws can all use a 60-deg. thread. When it is necessary to have a rapid acting screw of small diameter, a 60-deg. form can be used and the thread made double or triple.

In many cases it is difficult to cut a full depth thread having a helix angle greater than 8-deg. and at the same time produce a good finish on both sides of the thread. This is because one side of the cutting edge has a positive cutting angle and the opposite side has a negative cutting angle. This condition aggravates tool trouble. However, threads having a helix angle up to 16 deg. are being successfully cut. In these cases, it is essential that the thread have a modified depth and that the throat on the chasers be made long enough to distribute the cutting edge over as many teeth as possible.

Avoid Square Threads

The most expensive form of thread to machine is a square thread. It is accepted that this form cannot be successfully machined.

Fig. 2 shows a modified square thread as to form, while Fig. 3 shows a modified square thread as to form and depth. These threads will, in most cases, answer the purpose of a square thread. If possible, of course, the Acme form should be used in preference to a modified square thread.

Acme and square threads are often used where the outside diameter of a screw acts as a surface for a bearing or bushing. When this is required, the form should be special in that the outside diameter of the work should not be cut with chasers. The width of the flat on the crest of the thread must be specified as being narrower than standard; otherwise, when the pitch diameter of the work is reduced below basic, to permit a free fit, the outside diameter will decrease with it. Therefore, when the outside diameter is required to be held to basic and the pitch diameter below basic, this should be on the drawing.

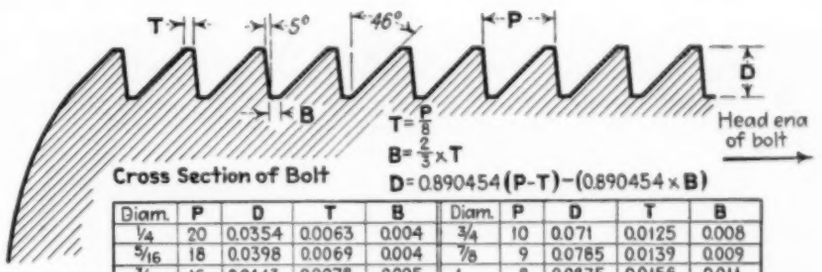
Fig. 4 shows a special Acme thread having a rounded crest instead of a flat. This form is a good one for use on leadscrews or screws which use a split nut engaging the thread. The rounded top permits the engagement of the nut without damage to the corners of the thread. A nut that engages a screw having a flat crest, such as a leadscrew nut, has a tendency to shear the side of the thread when the nut is engaged. The rounded top also permits freer engagement between the nut and screw. This form may be made the same as a standard Acme except to have the radius on the crest.

Fig. 5 shows a modified Harvey Grip thread. This also answers the purpose of the buttress form of thread. The sharp crest, root, and 1-deg. side angle have been changed to a 5-deg. side angle on thrust side of thread, and the crest and root each has a flat. This flat crest and root, together with the 5-deg. side angle, make the thread machinable with dies. The width of the flat at the root of the thread is less than that at the crest. This permits clearance at the root of the thread as the tap form is just the reverse.

This modified Harvey Grip thread is used when the thrust is on one side of the thread, such as on vise screws. However, the Acme form is more commonly used, as it can be machined with less difficulty.

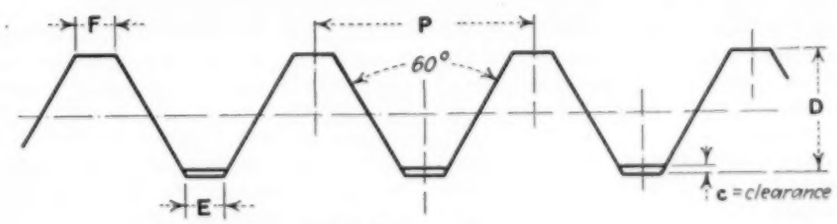
Fig. 6 shows a modified 60-deg. thread. This is used for fitting up bolts, and it will stand more abuse than regular National forms. In addition, the pitch is coarse, thus permitting quick assembly.

It is surprising to know how many different forms and pitches are used for fitting up bolts. This chart was based



Diam.	P	D	T	B	Diam.	P	D	T	B
1/4	20	0.0354	0.0063	0.004	3/4	10	0.071	0.0125	0.008
5/16	18	0.0398	0.0069	0.004	7/8	9	0.0785	0.0139	0.009
3/8	16	0.0443	0.0078	0.005	1	8	0.0875	0.0156	0.011
7/16	14	0.0503	0.0089	0.006	1 1/8	7	0.1006	0.0178	0.012
1/2	13	0.0535	0.010	0.007	1 1/4	7	0.1006	0.0178	0.012
9/16	12	0.0588	0.0104	0.007	1 3/8	6	0.1182	0.0208	0.013
5/8	11	0.064	0.011	0.008	1 1/2	6	0.1182	0.0208	0.013

Fig. 5—When the thrust is on one side of the thread a modified Harvey Grip form may be found advantageous



$$D = 0.406 \times P + C = \frac{0.406}{\text{No. thds. per inch}} + c$$

$$F = 0.2656 \times P = \frac{17}{64 \times \text{No. thds. per inch}}$$

$$E = 0.2656 \times P - 0.0057 = \frac{17}{64 \times \text{No. thds. per inch}} - 0.0057 = \text{5- pitch and finer}$$

$$E = 0.2656 \times P - 0.0092 = \frac{17}{64 \times \text{No. thds. per inch}} - 0.0092 = \text{4 pitch and coarser}$$

Diam.	Thds./In.	C	D	E	F	Diam.	Thds./In.	C	D	E	F
3/8	9	0.005	0.0501	0.0238	0.0295	7/8	5	0.005	0.0862	0.0474	0.0531
1/2	8	0.005	0.0557	0.0275	0.0332	1	5	0.005	0.0862	0.0474	0.0531
5/8	7	0.005	0.0630	0.0322	0.0379	1 1/8	4	0.008	0.1095	0.0572	0.0664
3/4	6	0.005	0.0726	0.0385	0.0442	1 1/4	4	0.008	0.1095	0.0572	0.0664

Fig. 6—A modified 60-deg. thread will stand abuse and permit of quick assembly

on the average form used by different companies for fitting up bolts.

One important detail in thread design is the width of undercut allowed for threads. As stated before ⅛ in. appears to be the accepted width of undercut or depth of counterbore in a tapped hole when the work has a thread against a shoulder.

This is an expensive practice, as it forces die makers to use a short throat on the chasers. This means decreased chaser life and greater difficulty in producing smooth threads.

Width of Undercuts

The thread length of a chaser for a 60-deg. form of thread in National Coarse or National Fine threads should be such as to permit of the use of no less than a 20-deg. thread angle. The width of the undercut can be established by multiplying the thread depth by the cotangent of 20-deg..

A 15-deg. throat angle will produce a better finish and will also give a longer chaser life. This throat should be used wherever possible.

No less than a 30-deg. throat should ever be used, and this only when design demands it.

For coarse pitch threads, especially Acme or modified square threads, a 12-deg. throat angle should be employed.

For double threads, a 9-deg. throat is necessary to permit the cutting action to be distributed over a sufficient number of teeth to produce a smooth cut and to eliminate the throwing of too much duty on the chaser throat.

When excess stock must be removed from the outside diameter of the work, a throat starting below the root of the thread should be used. In this case, the depth of the thread plus the distance the throat starts below the root of the thread, multiplied by the cotangent of the throat angle, equals the length of the throat.

The writer knows of many cases where the width of the undercut was changed, thereby allowing a longer chaser throat to be used. By doing this, the chaser life was more than doubled between grinds, and the finish improved.

The length of the throat on chasers for heat-treated materials is an important factor in cost, finish and production. For instance, in one case an average of twenty automobile axles were threaded between grinds when using 30-deg. throat chasers. By changing the drawing so as to permit of the use of a 15-deg. throat, the number of axles threaded per grind of the chasers was increased from 20 to 300. In addition to this, a great increase in the number of axles threaded per grind of the chasers and a better finish were obtained.

Discounting the Other Fellow's Brains

JOHN R. GODFREY

The one great weakness of self made men is not so much that they worship their maker but that they seem to get the idea that the pattern was lost and the material exhausted when they had finished their particular job. I presume its a very natural weakness. Not having arrived at that stage myself I can't say from personal experience. And perhaps the natural, but very disagreeable, result is that the S.M.M.'s are apt to put everyone else in the damphool class without stopping to inquire as to the reason they are not training in their particular group.

It may very well happen that they are right in most cases, there's a heap more of us than many like to admit. But it does jar the inner conscience a bit to be classed with the idiots and otherwise undesirables when we happen, quite accidently of course, to be doing something that is perfectly right, if the S.M.M. only looked below the surface, as he used to do before he arrived.

In one particular case I remember a perfectly good and harmless workman, who had the best interests of the shop at heart so far as he knew them, got a terrific call down from the boss for burning an electric light while the curtain at his window was drawn down. "Any man with a spoonful of brains would put up the curtain and not waste juice" sputtered the S.M.M. as he stormed into his office, decrying the stupidity of mechanics since the day he was in the shop himself. No wonder they didn't succeed.

But there happened to be a reason for the seeming foolishness. Over on the other side of the tool room, close by a window, was a man at work on a delicate jig that the boss wanted in a hurry. And the man minus the brains, had pulled his curtain down to keep the setting sun from striking the other man square in the eye. On this account he needed the light, but a few cents worth of juice was of no consequence compared to the work on the jig. This was what the S.M.M. didn't stop to find out. Not because he meant to be unfair, but because he had all along nursed the idea that he had a monopoly of the kind of brains that counted, or else the other men wouldn't have been working for him. It's a bad habit of thought, and the sooner the S.M.M. gets it out of his system, the more really and truly great he will be. Discounting the other fellow isn't always a safe game to play.

'Twas this particular case that really started my old friend Jimmy Jackson away from the old shop and into a new line of work, where, strange to say, he succeeded remarkably well. He'd been working for the S.M.M. until he, the S.M.M., was convinced Jimmy didn't know enough to go in out of the rain. That means that Jimmy hadn't been able to talk him into adopting any of the devices he had worked out. And after the curtain episode Jimmy got busy with a vengeance and did what he ought to have done long before.

Then after he had made a very favorable deal with a ready made shop owner, (which means his dad had left the money ready to start him in business) he paid the S.M.M. a visit to give his notice, and spake unto him something after this fashion.

"Being as I have it from your own lips that the full quota of brains in my cranium wouldn't crowd an after dinner coffee spoon, I just naturally concluded you wouldn't be heart broken at losing such a worthless incumbrance from your payroll. So I've induced young Billson down the road to not only give me a job, but to build some of those presses I've been trying to interest you in. And, while I'm duly sorry for Billson, I just couldn't bear to burn any more of your juice even if Bronson was saving ten times its cost over on the Rivett lathe, and I guess I'll be quitting about Friday night."

'Twas a long speech for Jimmy but he'd been getting madder every minute since it happened, and then what do you suppose the inconsistent S.M.M. went and did? Told him he wasn't fair to the man who'd made him what he was. Pulled all the loyalty stuff you read about in speeches at banquets but seldom see practiced toward the fellow with the dinner pail. And threatened to prevent Billson from making Jimmy's press because he saw it first, no matter if he had turned it down. The idea was due to working in his shop and it was his even though it wasn't worth two hoots in Halifax. But of course he didn't interfere at all, that was all bluff.

Fortunately there are other brands of self made men. But it's a tendency to be guarded against the minute you begin to feel that you are really going to be successful. Because if you wait until you really are, nothing short of an earthquake can make you believe that even the whole solar system isn't tied up close to you in some mysterious way. I don't expect to need to practice preparedness of this kind for some time to come.

Welding Quality Control

In Aircraft Manufacture

P. N. JANSEN
Factory Manager

AND

T. H. SPELLER
Welding Engineer
Curtiss Aeroplane & Motor Company

Tackling the problem of getting better welds, the authors first found it necessary to classify the many types used in airplane making. A realistic solution furnished the means for training new welders and checking the work of the older men

AS ENGINEERS familiar with aircraft welding may too well realize, the problem of developing and operating a satisfactory quality control method for this work is made particularly difficult by the great number of joint types current in aircraft designs. Another circumstance is that the thin gages and the lack of continuity of welding on some joint types cause aircraft welding to bear little semblance to, for instance, building structure or pressure vessel welding. This makes it impossible to adopt directly anything but general principles from the very excellent codes of practice of these and other applications. Because of these greater difficulties, aircraft welding quality control has had a development out of step with the increase in demands placed upon aircraft structures. Realizing this condition, the Curtiss Aeroplane and Motor Company some time ago began the study of the problem in a more comprehensive way. The results of the study led to developing and adopting a detailed procedure control method applicable in particular to aircraft welding.

Until the new methods of control were added, locating and correcting faulty welding depended on a rigid supervisory system of one lead man or supervisor for every ten or twelve welders and a 100 per cent inspection of all finished welding by the regular inspection department.

The supervisors are welders of long experience and proved skill at the trade. Their duties are to show the men under them the best method of welding new work and then to see that the work is being done as planned. The inspection department looks over all welding after it has been sand-blasted to find defects such as heat cracks, undercut base metal, cold laps, extremely rough or uneven fillet contours and improper fillet sizes. Work found defective is routed to a salvage room. This is a clearing house for bringing defective work from all departments, including the welding shop, to the attention of a regular committee. This committee, which is composed of a representative of both inspection and engineering, decides upon the disposition of defective parts and initiates necessary preventative measures. Army or Navy inspection is also represented when the work is connected with Government contracts.

In the study no fault could be found with the way this system was being carried out. In fact the record of failures attributable to faulty welding is remarkably low. Therefore, it was decided to make few if any alterations in existing practices. The new methods were to be in the form of agencies which would aid the welding department's judgment in planning correct welding methods for new jobs, collecting more detailed information about the ability of the individual welders, and thus make welding failures still less numerous or actually non-existent.

Fig. 1—These Curtiss P-6E Hawk parts illustrate the variety of welds encountered. A "single strut" landing gear leg is shown in the background. The small parts are marked for cutting and examination

Abstracted from a paper presented before the American Welding Society at the National Metal Congress, Detroit, October 5, 1933.

It might be stated that only gas welding is referred to here. Also, the base metal, or material welded, is chrome molybdenum (SAE 4130) steel, exclusively.

Much care was taken in classifying the various types of welding used in current aircraft designs and determining how frequently each class occurred. Doing this indicated the problem with which we were dealing in a somewhat clearer light. This classification developed into quite a problem in itself because there apparently was no known method of doing this in existence.

Some preliminary tests showed that one of the major causes for variation in quality was this great number of different joint types. Nine representative welders were requested to make the same type weld samples and, in order to assure their best efforts, informed of the fact that the samples would be tested. Examining and grading the welds showed the average grade to be 56.3 per cent. After talking over the merits or faults of each sample with the welders, a new set was welded and graded. In this case the average rate was 72.2 per cent. The same nine men were then given a set of samples of an entirely different type, perhaps a little more difficult, but also frequently found in aircraft welding. The average grade was 51 per cent and the retrial grade as 67.8 per cent. This same test was repeated in a number of ways and with other groups of welders, always with the same general results. In other words, breaking the welders in on one type of weld helped little on the second type. To be able to classify quickly new welding work and then assign it to welders of known ability in that type, therefore, became important. Also knowledge of which weld types occur most frequently was necessary as a basis for the design of a qualification test to obtain information about the ability of new welders. A definite classifying system, together with the average grades for welds examined in each class, also is useful to the engineering department in the design of details more practical from a welding standpoint.

Fig. 2—Welders are broken in on structurally important joints by samples requiring the same technique as the joints themselves

The basis decided upon was to divide all types of joints into a maximum of from twenty to thirty groups so that the welding technique would be similar for all the joints classified as belonging to one group. Differences in welding technique imply differences in such factors as speed of welding, size of flame, proportion of fillet and method of getting complete fusion without overheating either side of base metal. To show how the welding on an airplane of more

Table I—Classification of Welds

Class	Welding Time, Hrs.	Total Time, Per Cent	Average Grade Production, Per Cent	Average Grade Tests, Per Cent
Simple welds				
Fillet welds (90° to 150° included angle)				
Light (0.031–0.063)*	76.8	14.3	61.6	74.6
Medium (0.064–0.093)	67.6	12.5	68.5	
Heavy (0.094–0.250)	68.5	12.7	66.3	89.8
Lap welds				
Light (0.031–0.063)	31.6	5.9	60.6	78.2
Medium (0.064–0.093)	37.0	6.9	63.0	
Heavy (0.094–0.250)	20.4	3.8	57.2	65.3
Edge welds				
Light (0.031–0.050)	8.3	1.5	56.4	52.0
Medium (0.051–0.093)	12.4	2.3	51.0	45.6
Complex welds				
Fillet weld at an acute angle				
Light (0.031–0.063)	56.2	10.5	49.2	68.1
Heavy (0.064–0.250)	43.5	8.1	56.1	73.4
Welds with unequal heating				
Fillet welds				
Light (0.031–0.125)	2.1	0.4	54.8	
Heavy (0.126–0.250)	56.9	10.5	63.3	62.2
Lap welds				
Light (0.031–0.125)	3.1	0.6	45.4	
Heavy (0.126–0.250)	14.3	2.7	53.19	59.3
Light welds (0.031–0.063) with close edge				
Fillet	21.3	3.9	42.19	47.9
Lap	8.3	1.5	54.89	
Special complex welds				
Heavy acute angle welds with unequal heating	6.2	1.1	47.5	54.6
Light acute angle welds with unequal heating	1.0	0.2	39.4	
Light acute angle fillet weld with close edge	2.4	0.4	37.1	
Totals	537.9	100.0	54.0	64.2

* These figures refer to the base metal thickness in inches. If the two sides of the joint are of unequal thickness the figures refer to the average of the two.

or less conventional construction would be distributed under the various classes, the welding on the Curtiss P-6E Hawk is classified in Table I. This airplane has a welded tubular steel fuselage, welded "single strut" landing gear, wing fittings made of welded sheet steel, and various supports and brackets for controls, equipment and armament installation, also made of welded sheet and tubing. (See Fig. 1.)

Since it was possible to bring about such marked improvement by means of constructive criticisms based on the cross-sectional appearance of a similar weld, it became evident that some testing agency for aiding the leadmen in breaking in welders for new jobs could also do some effective work by similar methods. The procedure successfully employed is for an individual familiar with both design requirements and welding problems to look over shop drawings at the time they are released for production. Certain welding jobs which appear difficult or which are particularly important structurally are picked out. The next step is to arrange that the welding department assign a definite crew which alone will weld these jobs.

New Welders Trained on Samples

Test samples are designed with the idea that they need be similar to the actual part only in the method of welding. These can be made quite inexpensively as can be seen by the sample shown in Fig. 2. The samples are welded by the picked crew and then sectioned and examined or strength tested. Strength testing is the usual thing in break-in tests because the samples can be planned for easy testing. Also strength tests give a check on the factor of safety of the joint's design if it is certain that the best method of welding has been developed. Welding is not begun on the actual work until after a sufficient number of samples has been made and tested to show that an adequate welding method has been developed, and that the entire crew has mastered it. It has been found that out of a crew of, for instance, five men, only two may have to repeat their samples. Usually only one repetition is necessary, the welder and welding foreman having obtained enough information from the type of failure or appearance of the cross-section on the first sample to correct the faults.

It has also been the company's practice for quite a few years to center responsibility in the welding foreman for hiring welders of adequate ability. The foreman gives the welder seeking employment a sample to weld. The foreman bases his judgment of the man's ability to a great extent upon his performance on this sample, observing such points as the way he picks up, holds and adjusts the torch, how neat a fillet is built up and how many times he burns through the light sheet. However, with this method it takes many weeks of close observation before it is possible to learn on which of the many types of work the new man is most proficient and on which types he might need coaching. Therefore another field

Fig. 3—Proficiency of each welder is recorded on two cards, one for his test work and another for samples of his production welding

to aid the welding department was to supply information regarding new welders' ability on the more important types of aircraft joints so that new work could be assigned to the right talent a short time after employment.

Because such a test involved considerable labor (about 3 hr. for preparing samples, 5 hr. for welding and 2 hr. for testing), it was decided, as mentioned before, to continue basing welders' employment on the foreman's opinion as to how a man performs on the preliminary test. The new set of samples is used, therefore, for expanding and recording the information about the man of whom the foreman already has a fairly general opinion. Using the classification in Table I, the necessary test was designed.

Samples in this test include twelve classes of work, all of which are found quite frequently in aircraft work. It is expected that the welder, knowing his ability is being tested, will exert his best efforts. Hence, the qualification test shows examples of his best work. Since samples of fillet welds are hard to strength test, some of the samples are sectioned and graded by examination according to the method described later. The lap and edge weld samples, however, are arranged to be strength tested as well as etched and examined and are graded as a percentage of the unwelded sheet strength. A column in Table I gives the average results of tests given to forty welders using this sample.

Since the welders given the test had been with the company for quite a while, it was interesting to compare the foreman's opinion of a welder's ability against the test record. In all but three of the 40 cases the check was quite close.

As stated above, one of the duties of the leadman, or supervisor, is to watch his men for evidences of carelessness or use of wrong technique. An effective way of aiding him along this line was found in providing a percentage check of the welder's work by destructive tests. This percentage, of course, is necessarily rather small for reasons of economy. The effect to be gained, however, is the welders' realization of the possibility of the quality of their work being checked from time to time.

Production Welds Are Tested

The procedure set up for this phase of the work and successfully operated for quite some period is to select at random five to ten welded parts per week for every thirty welders employed. To keep the expense of this practice low, some discretion is shown so that the parts selected have not involved too much non-welding labor or that destruction of the part will not seriously affect production schedule requirements. Some effort is also made to choose work of welders whose record is erratic or incomplete. In periods of increased production it is possible to get most of the parts for test from the salvage room, since many parts find their way there because of defects such as dimensional errors or accidents in drilling holes. The selection of samples is done by a non-welder such as the welding engineer or a member of the company's inspection department. The welding is identified through distinguishing letters which each welder stamps on the seams which he welds.

The most convincing way of making the tests would be to break up the assemblies with loads applied in a manner similar to service demands. As might be expected this would require expensive test fixtures and would be wholly impractical in most cases. Therefore, the usual method is to section the welded part at such locations as to reveal several examples of each class of welding on the part. The welds are then etched, graded and the grading details

Table II—Standard Fillet Proportions

Sheet Thickness	Fillet Welds: Max. Leg	Fillet Welds: Max. Leg for Acute Angle Welds	Fillet Welds: Min. Throat	Lap Welds: Max. Leg	Lap Welds: Min. Fillet Thickness Measured 1.5T from Edge of Upper Sheet
0.031	0 13	0 16	0.06	0.22	0.03
0.038	0 15	0.19	0.07	0.25	0 04
0.050	0.19	0.24	0.09	0.30	0.05
0.063	0.21	0.26	0.10	0.33	0.06
0.078	0.25	0.31	0.12	0.35	0.08
0.093	0.28	0.35	0.13	0.37	0.09
0.125	0 34	0.42	0 16	0.47	0.13
0.180	0.40	0 50	0.21	0 62	0 19
0.250	0.57	0.71	0.27	0.75	0.25

recorded as information regarding the welder's proficiency on that particular class of weld. The method of filing records and storing the cut-up samples is shown in Fig. 3. The results properly classified aid in assigning new work to the right welding talent. A column in Table I shows average grades which have been found for welds in various classes. These averages are made up from 364 weld samples in all, the most frequent occurring type, of course, having the greatest number of samples. After grading, the merits or faults of a sample are thoroughly discussed with the welder so that maximum benefit may be derived.

By examining Table I it can be seen that the average of test sample grades, on the whole, is 10.2 per cent higher than the average of production welding grades. This, of course, is because of the difference of working under the pressure of knowing the piece will be tested. Certain inconsistencies are probably caused by lack of sufficient samples to make up good averages.

Because of the difficulty of testing complicated fittings, it was found necessary to develop a method of grading welds from the appearance of an etched cross-section. The method had to be uniformly adaptable for all classes of work so that disagreements might be avoided in discussing the quality of a weld. Grading in this way has advantages and disadvantages over strength testing. The defects can be broken down into greater detail, thus giving a better clue as to how they might be avoided. However, the results of visual grading are not as convincing as are strength tests when discussing the result with individuals unfamiliar with the details of the method of grading. The method was developed keeping in mind that the grade should give an idea as to the strength of the joint. But to do this accurately was found to be difficult and not wholly desirable because it is thought necessary to make certain deductions for such things as rough appearance, a defect having no direct relation to static strength. As in the case of the method of classification, no claims are made that the present method of grading is completely evolved. From time to time it may become necessary to make changes in the amount of deductions made for certain defects when additional information concerning their importance becomes available.

It has been found that different individuals grading the same weld by this method will agree in most cases within 10 per cent and usually never more than within 25 per cent.

Grading Fillet and Lap Welds

(*a*) *Fusion*—All joints of a similar class are first examined for adhesion of the deposited metal to the base metal. The upper part of Fig. 4 is a section of a light acute angle fillet weld of which type there may be six or eight sections cut from the weld assembly under examination. Visually estimating from the apex of the joint, the upper side has 50 per cent fusion and the lower side 80 per cent. Since failure would occur through the 50 per cent of adhering metal on the upper side, that 50 per cent is averaged into the low fusion sides of the other six or eight sections and the sounder side neglected. The resulting average would be the grade for this particular sample of light acute angle fillet weld, providing no other defects as listed below are present.

(*b*) *Appearance*—External defects such as uneven appearance, splashed weld metal or weld metal not smoothly fused to base metal at edges, although not serious in themselves, are undesirable. Up to 10 per cent is taken from the fusion rate, depending on how bad the defect.

(*c*) *Fillet Sizes*—It is necessary to standardize fillet sizes between certain limits for the following reasons: Too large a fillet may be responsible for excessive sheet warpage, overheated base metal, unnecessary weight or labor expenditure and particularly interference with mating parts. Too small a fillet is rather uncommon in light and medium weight welds but obviously would result in decreased strength. Table 2 gives tentative standard fillet dimension limits.

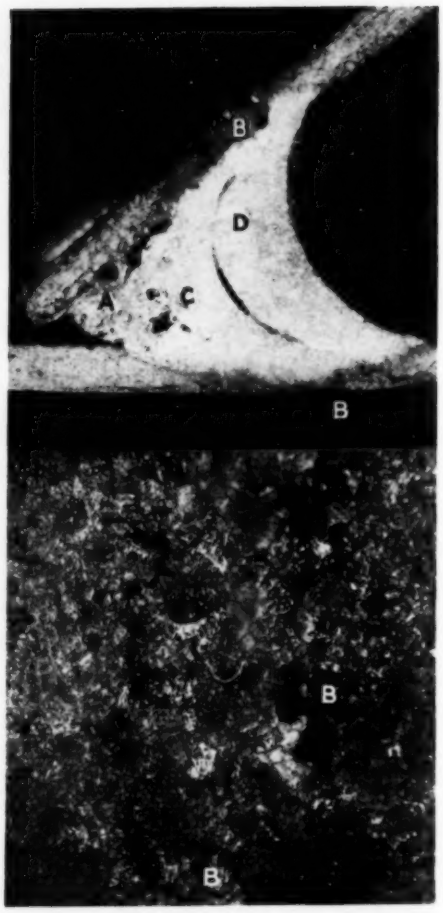


Fig. 4—Etching brings out typical defects in a fillet weld. (Mag. 6 X) *A.* Lack of fusion. *B.* Evidence of burning. *C.* Porosity. *D.* Failure to get fusion of the additional rod when fillet was run over a second time. *E.* Apparent warpage of the base metal caused by too large a fillet

A 5 per cent rate deduction is made for oversize fillets, such as the one shown in Fig. 4. In cases of undersize fillets the per cent undersize is the rate deduction.

(*d*) *Porosity*—Because of the present lack of more exact information, up to 10 per cent is taken off for porosity or inclusions.

(*e*) *Lack of Fusion within the Fillet*—Welders sometimes go over their work a second or third time to build up the fillet. When this is done and there is imperfect fusion between the added metal and original fillet, 10 per cent is taken off.

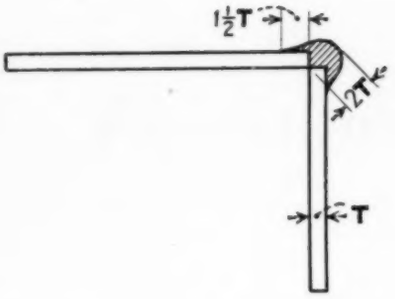


Fig. 5—Minimum proportions of weld fillets are shown for edge welds

(*f*) *Burning*—Damage to the base metal because of overheating and burning is a defect equal in importance to lack of fusion when considering the over-all strength of the joint. Rightfully the joint should be considered as a chain of two links, one of which is the deposited fillet and the other the adjacent base metal. The weaker of the two should be evaluated as a strength percentage of the unwelded base metal in determining the rate for the joint. Unfortunately, up to the present, the opinion of the person examining the weld plays too great a part to base an accurate grade for the joint on the amount of burning alone. Instead the following arbitrary method of rating for this defect is resorted to. After considerable experience in examining welds, it is possible to divide the degree of damage into four or five classes, depending on how many places along a seam the sheet was burned through or how and numerous are any heat cracks. For a very slight condition 5 per cent is deducted, for slight 10 per cent, medium 15 per cent and bad 20 to 30 per cent. These percentages are taken from the fusion percentage similar to deposited metal defects. This is because the present method of evaluating burning is not definite enough to be the sole basis for condemning the quality of the joint. The likelihood of arriving at an over-all grade less than 0 per cent is remote because excessive burning usually, but not necessarily, means a high percentage fusion. Note the evidences of burning shown in Fig. 4. The under side of the sheet (lower half of picture) shows several places where the welder burned through. Also incipient heat cracks are noticeable on both the sheet and section.

Method of Grading Edge Welds

In this class of weld, lack of fusion, abnormal damage to base metal, porosity or uneven appearance hardly ever occur. The main things are the location and thickness of the deposited reinforcement. The minimum proportions of the fillet are shown in Fig. 5. No maximum is set because welding conditions ordinarily limit the size. The grade for a joint is obtained by estimating the percentage that the fillet proportions differ from the standard.

Up to Industry—*Discussion*

JOHN H. HERTNER
Hertner Electric Company

D. B. Richberg (*AM*—Vol. 77, page 457) of the N.R.A. explains at length some of the questions which manufacturers are asking. There are a few points on which he is a little obscure, some points where he seems to be wrong, and some where he calls upon the weighty argument of ridicule to prove his case.

Almost half of the article consists of abuse of the business man—his despising "book learning" and his reliance on "rugged individualism," mingled with well spread praise for the college professor and the "trained and impartial economist."

The President in a recent address dealt somewhat differently with the economist where he said that these brethern changed their system of ideas once every ten years — or was it five years. This does not fit in with the opinion of the learned counsel. We might add that Congress, composed largely of legal talent, has been consorting considerably with the professors and economists in the drafting of quite a few of our more recent laws—the income tax law for one—with the result that it is so beautifully complicated and so vague on many points that its enforcement is a scandal, and it is so unjust that it is a source of national reproach.

Economics is called a science. It is a collection of facts and fancies, largely fancies, colored by the personal prejudices of the economist.

Business has not always been right and business men have made mistakes, but we have had no indication or assurance that the professors and economists can do any better. It is folly to blame our present condition to the failure of industry to do its part. For many years until into 1930 industry has employed more and more of the country's workers and at increasing hourly rates while in other pursuits, particularly agriculture, employment fell off. Living in the cities became easier and more attractive as compared with life on the farm.

Taxes Gobble Income

Our critics forget, too, that taxes have risen to a point where in 1931 they consumed 22 per cent of the public income. If there is any one item that has reduced "purchasing power" of which they speak so glibly and continuously it is certainly taxation.

The learned counsel also makes the statement that the law is a challenge to industry and to labor. It is hard to see where it is any challenge to labor. Industry is called upon to recognize union labor, but no where is labor told to recognize industry. Will it be possible for an American citizen to get a job in a factory once unionized unless he pays tribute Will the union leaders still have the power to forbid their members to accept a job in an open shop?

Jurisdictional strikes that tie up unions not involved, the employer, and the public will apparently still be in full bloom until the leaders can unravel the tangles to their own satisfaction.

Why should not the employer confronted with this have misgivings? He is told to sign. Then if things go wrong to take it to his trade association and from there to Washington, agreeing to abide by whatever decision is made.

We all want prosperity. We all want full employment. The proper course is the point on which we differ. Sometimes the wisest physician does not recommend an operation but puts more faith in rest and quiet.

We are warned that this is industry's last chance, that perhaps complete socialization of industry "will come if the present test fails." That "if this experiment fails it will not be the fault of the administration." Is this to be considered a preparation made to throw the blame of a contemplated failure off the shoulders of the administration and onto industry which is apparently helpless?

[*The author discusses an address made some weeks ago, but in view of later addresses by Mr. Richberg and the wave of strikes that is spreading over the country his remarks have added force.*—ED.]

Cost Finding to Assure Profits—IV

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Next to labor, discussed in the last number, material costs rank in importance. Procedure for inventory and stores control, establishment of base prices for productive material, and uses of the material digest are described

MOST manufacturers meticulously guard and account for their cash as a matter of course. They are hard-boiled and shrewd when exchanging that cash for materials. But they are not always equally careful in protecting, utilizing and accounting for the materials their cash has purchased.

Yet materials should be of at least as much concern to the manufacturer as is cash. Material cost is a substantial part of the total cost of the product in most branches of the metal-working industry. Common prudence therefore dictates that material should be accounted for accurately and that cost-finding methods should provide controls that will positively indicate misuse, abuse, deterioration, substitution, pilfering—in fact all kinds of preventable waste—and which will promptly bring to executive attention any material usage in excess of that predetermined.

The more expensive a material is, the more necessary it becomes to protect it and to control its use. If for no other reason than this, the National Industrial Recovery Act should stimulate the use of cost methods which will provide positive, current and reliable material cost-control information, for it is more than likely that under NIRA prices of materials will rise. Also, under NIRA, the low-cost producer will have a distinct advantage. Therefore, it is important to keep material cost at a minimum, without substitution or cheapening the product. Any preventable waste of material will unwarrantedly increase the product's cost and so constitute a definite handicap to the producer.

Fortunately, cost accounting for materials presents few theoretical or practical difficulties. Of all cost elements, it is most readily subject to accurate control. For productive materials, the calculated requirements should closely approximate actual usage.

Because of the frailties of the human factor, the labor element in costs is subject to wide and volatile variations. Variations in the use of material do, of course, occur, but material has the great advantage of being tangible. When variations from predetermined usage do occur, they are likely to be much more evident than fluctuations in the use of labor. Therefore, once good housekeeping and economical use of materials have been definitely established, wide fluctuations are not likely.

For that reason, it is usually sufficient to control material costs on a monthly or cost-period basis. However, when material cost is a major portion of the total cost, it may be desirable and well worth-while to review the material usage weekly or daily. Thus, in making sani-

PAGE NO ____
MONTH _____ 19__

INVOICE REGISTER

ENTRY NO.	INV. DATE	CREDITOR	CHECK NUMBER	DATE PAID	ACCOUNTS PAYABLE		PRODUCTIVE MATERIALS		A/c NO.	SUPPLY MATERIALS	
					GENERAL	PRODUCTIVE MATERALS	BASE VALUE P. & L.	BASE VALUE			
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	

Fig. 5a—Actual cost is readily compared with base value in this invoice register

tary cans, there should be daily reports of tin-plate and solder usage against the unit cans produced, for a considerable excessive use or wastage would seriously run up the total cost of the product. Fortunately, in the can industry, daily control is both feasible and inexpensive. In some few cases, where daily or weekly control might be highly desirable, it would not be practical nor economical. By and large, from a cost point of view, monthly or cost period control is the rule—weekly or daily control the exception.

Where wide fluctuations in specific items of productive material usage are likely to occur, it may be more practical to use production records as a source of control of such conditions. The quantities will satisfactorily disclose excessive usage immediately.

It is not possible to describe in complete detail a material control procedure that would be applicable to all plants in the metal-working industry, for the methods necessarily vary according to the type of plant, the nature of the products, the materials used, the type of production—whether mass, jobmass or job—the level of skill of the workmen employed and many other conditions. These variations, however, do not militate against the use of uniform cost-finding in any branch of the metal-working industry. While the detail methods may differ, the principles described are uniform.

Material Classification

Accounting for materials naturally starts with the purchase. It is assumed that the purchasing routine is established and that the personnel and procedure is sufficiently efficient to secure the needed materials at reasonable prices. All purchased materials which receive specific cost consideration usually fall into one of the following general classifications:

I. Productive materials:
   1. Direct
      a. Unfabricated
      b. Partially fabricated
      c. Fabricated (ready for assembly)
   2. Indirect
      a. Processing materials such as cutting compound, cleaning solutions, grinding and polishing materials and so on.

II. Non-productive (or supply) materials:
   1. Fuel
   2. Manufacturing supplies such as small tools, bolts, nuts, rivets, bar stock, packing materials and other miscellaneous standard materials not used for productive purposes.
   3. Maintenance and general supplies such as oil, belting, light bulbs, spare parts and so on.
   4. Office supplies.

Materials for capital accounts such as equipment, building materials and the like are not listed here because, when they are reflected in the costs, they get into them deviously through expense rather than directly as material. In this article only productive materials are dealt with. Non-productive, or supply, materials, together with other expense items, will be dealt with in the next article.

Correct pricing of materials is essential to accurate cost finding and control. Unfortunately, material prices have a way of fluctuating, sometimes suddenly and to a considerable extent. The manufacturer has no direct control over these price changes. But he must usually quote firm prices on his finished product. This means that he must have a base raw material price to use in figuring his product cost. Furthermore, if he expects the cost figures to reflect correctly the operating results, the base material price must follow through the entire cost-finding procedure.

To use current or average material prices for these purposes not only involves excessive clerical effort, but would be confusing for comparative purposes.

It is for productive materials that base prices should be established for cost-finding and control purposes. It is not necessary to set base prices for supply materials. In some purely job shops, it is not feasible to set base material prices nor to follow exactly the procedure which is described here. However, they can always be closely simulated.

Bases May Be Adjusted

Base prices for productive materials should be fixed to reflect the average price which can be reasonably expected to obtain during the period for which sales are planned and prices quoted. When commodity prices are reasonably stable, these base prices will usually serve without change throughout a general accounting period. Should unusual market price changes occur, which seem likely to hold for a substantial period, base material prices should, of course, be adjusted.

For cost purposes, the base prices of productive materials should include both the invoice price and the cost of incoming transportation. Both of these items ordinarily are carried in the inventory accounts and enter into the product as material cost.

The actual prices paid for productive materials, together with transportation charges thereon, can most conveniently be adjusted to the established base price

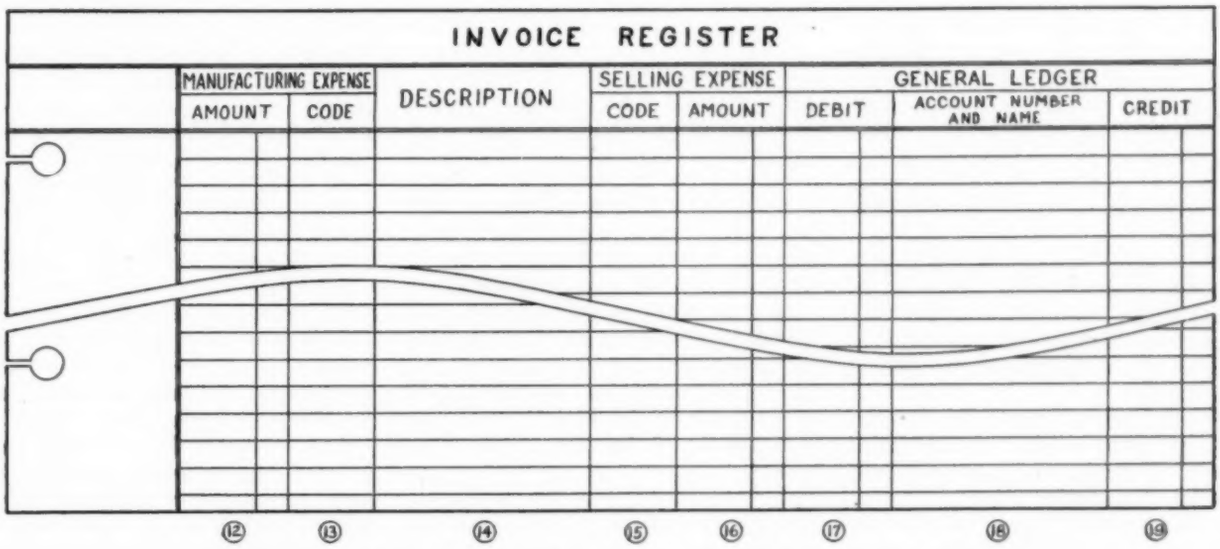

Fig. 5b—Material is credited on the page opposite the form shown in Fig. 5a

UNIT PRODUCTIVE MATERIAL DIGEST

PROFIT OR LOSS DUE TO MATERIAL PRICE AND USAGE

PERIOD _____ 19__

A/c NO.	MATERIAL CLASSIFICATION	MATERIAL PURCHASED — ACTUAL PRICE VALUE	MATERIAL PURCHASED — BASE PRICE VALUE	PROFIT OR LOSS DUE TO PRICE	VALUE OF ACTUAL USAGE	MATERIAL VALUE OF UNITS PRODUCED	PROFIT OR LOSS DUE TO USAGE
202		15850 00	16300 00	450 00	14357 50	14820 50	463 00
203		11748 20	11022 30	(725 90)	16918 25	17489 80	571 55
204		31675 15	32841 20	1166 05	28416 95	27841 85	(575 10)
205		21013 40	23411 15	2397 75	30029 15	29198 30	(830 85)
206		17624 35	17008 20	(616 15)	26414 80	28021 35	1606 55
209		4110 10	4317 35	207 25	11974 65	12316 70	342 05
210		10204 25	10320 40	116 15	9505 20	9605 30	100 10
211		5712 60	5202 55	(510 05)	6792 15	6281 10	(511 05)
		17344 90	[illegible] 10	216 [illegible]	12168 50	12452 20	283 [illegible]
234		[illegible] 10	14926 45	425 35	15[illegible] 10	15923 10	[illegible] 00
	TOTAL	204.042 40	209.800 40	5758 00	256.222 60	259.377 00	3154 40
①	②	③	④	⑤	⑥	⑦	⑧

Fig. 6—Profit or loss caused by material price and usage is clearly shown in this form of digest

as soon as the material is received and checked. When the invoice has been recalculated at the base price, it is ready for entry in the invoice register. The invoice register procedure is so generally understood that only variations from usual practice will be cited.

Use of Invoice Register

The invoice register sheet, Fig. 5, is suited for use by the small or average sized plant. Large companies may desire to set up separate invoice registers —one for all productive and non-productive materials and another for general purchases. With a separate material invoice register it is usual to provide columns for each material classification and P. & L. columns for each classification.

The actual amount of the invoice is posted to the material section of the accounts payable column (Fig. 5a, Column 7), and the base value posted to the proper inventory column (Column 9). The difference, plus or minus, is entered in the profit and loss column (Column 8). In order to segregate productive materials by various classifications, the account number is entered in Column 10 so that the amounts for such classifications may be later summarized.

At the end of the month, the posting from the invoice register sheet to the general ledger inventory accounts may be made in either one or two steps, as dictated by the desires of the general accountant.

In the one-step method, the total of the base value column (9) is posted directly to the inventory account, and the total of the base value P. & L. column (8) is carried directly from the invoice register to the productive material base value P. & L. account.

In the two-step method, the total accounts payable productive material column (7), which is the actual productive material cost value, is posted as a debit to the proper productive material inventory account in the usual way.

A journal entry adjusts the ledge accounts from the actual cost value to base value, and the difference is carried to the productive material base value P. & L. account.

The base price method establishes the productive material purchases for the month in the productive material inventory accounts and permits relief of the inventory into process accounts without referring to the original invoice prices.

Purchases of supply materials are handled into the invoice register and through to the proper inventory accounts in the general ledger in the orthodox fashion. It is generally good practice to handle supply material prices on an actual basis.

Accounting for Wastage

In the manufacture of any product, some loss of material is invariably sustained. For example, let us say that in making 100 shear pins the net material content is 100 pounds of cold-rolled steel. However, wastage in scrap ends of bar stock, spoilage, turnings, borings and so on makes it necessary to issue 7 per cent more bar stock than the net content. Therefore, 107 pounds of bar stock is issued and production of 100 finished shear pins from this amount of material is considered satisfactory performance. In the cost calculations, a material unit of 1.07 of the net material content is used as the unit quantity that should be required. The unit quantity multiplied by the base price for the material gives the material base cost. This cost is used as the material element in product costing.

Material units should be established for all products. In job shops, where there is little repetitive manufacturing, the material estimates, which should include an allowance for wastage, are used as the material units.

Practice Determines Allowances

It is seldom correct to use a set overall percentage to cover the fabricating losses and wastage over a variety of products, for in practice the percentages usually vary widely. Sometimes, however, it is possible to establish the allowance units by groups. In any event, the allowances should be the result of studied performance.

Since material stores' practices vary widely, no detailed, universally applicable rules can be set down. The procedures must be adapted to individual conditions and requirements in order to secure economical handling and protection of materials and proper accounting for their usage. Economy in handling should never be sacrificed to theoretical accounting considerations, for excess handling, of course, adds to the product cost. The detail procedure for determining or calculating the usage of both productive and supply materials should be adequate and at the same time economical.

Many job shops require the detailed reporting of every material issue. The job-mass and some mass production shops can generally handle material issues on a "blanket" basis. Other mass production shops, in which the variety is small, the production processes direct and the number of materials comparatively few, may use the unitized method of determining material usage. The unitized method is the simplest of all.

It requires a minimum of detail and permits positive control of material usage. Unfortunately, it is not generally applicable, but it should be used wherever possible.

No matter what procedure is followed, the important thing is to know when, where and how much the usage of productive materials varies from the usage provided for, or specified, in estimating the material cost of the product. These variations should be identified, and brought out in the productive material usage summary or material digest for executive attention.

Variations Are Summarized

At the end of each month, or cost period, the productive material purchases and usage should be summarized and digested by classification of inventories, which, if desired, may be broken down to major kinds of material. The digest should also show the break-down of the P. & L. caused by the price variation of purchases for the period. Variations from specified or estimated usage—that is, the P. & L. due to usage—should be summarized by classification.

In some instances, especially where continuous and large purchases of basic materials are involved, it is often desirable to show on the material digest, by classification of material, such data as "inventory at beginning of the period," "inventory at end of period," "quantity (or value) of materials on order but undelivered" and "estimated requirements for the next 30, 60 and 90 days," or other periods, as may be desired.

The material digest serves as an executive guide in the direct control of productive material purchases, usage and cost. It also serves as the medium for charging productive materials into process. When the inventory and order data is included, it provides the executive with a means of controlling inventory investment.

Non-productive, or supply material usage is summarized in the expense digest, the form and use of which will be described in the next article.

The unit productive material digest, Fig. 6, is the form used where complete unitization of material quantities is practical. In Column 7, material value of units produced, the predetermined or allowed value of the material used in the production obtained is entered. Column 7 minus Column 6 equals Column 8. In this fashion, through complete unitization, the P. & L. due to usage is obtained directly. This is the type of digest which, as has been indicated, may be made daily or weekly, if desired, without excessive expense.

WANTED

A VOICE for the Non-Union Worker

LUCIEN I. YEOMANS
Industrial Engineer

Many American workmen are opposed to the principles of trades-unionism, distrustful of union leaders. Who is to speak for them at this crucial time when industrial relations are facing revolutionary change?

IN YOUR editorial, "The Consumer's Stake," (*AM*—Vol. 77, page 28b) there are phrases which I think should not appear in such matter, nor in news articles in general, nor in the conversation of informed men of the industry, nor in the proceedings of manufacturers' associations.

We all have a tendency to refer to union labor as "labor" and this tendency is in evidence in the utterances of government officials, the discussions of legislative bodies, and the man on the street.

Your editorial is quoted in part, as follows: "In the NRA hearings so far held, labor has been vociferously aggressive, the employers doggedly defensive, the consumer practically silent. The principal reasons for this state of affairs are that labor is closely organized, industry generally disorganized, the consumer unorganized. And, as usual, the organized minority is getting the lion's share. The interests of labor and capital under NRA direction have been fully discussed in these pages, but we have had as little to say of the consumer as he has had to say for himself."

What I take exception to is the continually implied thought that union labor is "labor."

It should be continually impressed upon the entire country, and particularly upon the great number of people who work for wages, that it is *union* labor which is the highly organized minority and that the total membership is only a trivial part of *labor*. It should be forcefully brought to the attention of government executives and members of Congress that the real labor backbone of the country is strictly non-union labor and that it is this great majority that is unrepresented by anyone—unless it may be that the employers fairly try to represent them to some extent.

The important point which I am anxious to make is that non-union men are usually non-union on account of a deep-seated prejudice against the limitation of individual opportunity and leveling influences of unionism and not on account of indifference to the subject.

I am a machinist with a background of forty years experience, which includes the period of my apprenticeship, and I have had an unusual opportunity through my employment by a number of companies engaged in quite different lines of manufacture. A fair share of my shop experience has been in tool making and my machine shop practice has covered a wide range, from precision instrument work to the roughest class of heavy machinery. In addition to this, I have had some foundry and

forging experience and have worked for a long period as a pattern maker. My work has been in towns with population as small as three hundred people and as large as three million—in shops as small as ten employees and as large as fifteen thousand.

I have heard of "open shops" which were neither union or non-union, but I have never seen one. As I have found them, a shop is either union or non-union—depending upon which condition predominates and influences the situation. Call a strike in an "open shop" in which the union membership percentage includes only a quarter of the employees and nearly one hundred per cent of the employees "go out." Let a non-union man attempt to work in an open shop in which union labor predominates and he will shortly either join the union or seek employment elsewhere and, similarly, a union man who attempts to work in a shop in which non-union sentiment is strong will have his right to work there challenged before noon of his first day.

We are hearing a great deal about collective bargaining and "company unions" in these days and both are equally distasteful to the man who is non-union in principle. There may be some non-union men who are such on account of ignorance and indifference and lack of contact with union activities—just as there are many union men who are such because they are following the path of least resistance—but the great majority of non-union men are such as a matter of principle, as am I.

Small Percentage Unionized

This country was pioneered and became what it is upon the principle of individualism and opportunity and the union influences of the old country had no effect here for many years. In fact, unionism has never attracted labor in this country nor ever included but a small percentage of labor in union membership.

The labor union did not appear in this country for the first two hundred years of its history, despite the fact that during those centuries its maximum activity was reached across the ocean.

The first known trace of labor organization in this country was not until September 1832 and was a meeting of farmers and mechanics held at the State House in Massachusetts to protest against long hours of labor and imprisonment for debt. A meeting to form a general trades-union was held at the Boston Common Council rooms on January 21, 1934, and in the following March a constitution was ratified.

From 1830 to 1860 the labor unions amounted to nothing and intelligent workmen opposed such questionable business tyranny as less desirable than the free acts of employers.

The Machinists and Blacksmiths organized March 2, 1859 and the Iron Molders asked for a charter from the U. S. Government—which was refused—on July 5, 1859. About 1860 twenty-six trades had national organizations. The first Trades Assembly was in Cincinnati in 1864. An Industrial Congress assembled in 1873 at Cleveland and in that year the National Miners Union was formed. Amalgamated Iron and Steel Workers (1876), Cigarmakers International Union (1864), Locomotive Engineers (1863), and Locomotive Firemen (1873), were early unions.

Unions' Short Existence

Leo Wolman, himself, sets the year 1897 as a convenient choice of the beginning of the American Union Labor movement and speaks of the victory of American Federation of Labor over the Knights of Labor before that time, and only attributes importance to the Knights of Labor in the decade from 1880 to 1890. So we are talking about a forty-year existence of any importance in this country.

The total membership of American Trade Unions in 1897 was less than one-half million and the million mark was not passed until 1901, the two million mark in 1904. It fluctuated between two and three millions until 1917, when it just exceeded three millions, and from that point, through the war and succeeding years, rose rapidly and steadily to just over five million in 1920—which was its high point.

Wolman shows it decreased from that figure to three and three quarters millions in 1923 and he gives the total working population in that year as about forty-three millions.

About half of the union membership was railroad and building trades, which left less than two million to fill out the membership of about one hundred separate unions of which four-fifths are loosely federated under American Federation of Labor.

Membership figures, partly taken from Wolman and partly from recent letters from National Bureau of Economic Research, are tabulated:

1910	2,184,200	1921	4,815,000
1911	2,382,800	1922	4,059,400
1912	2,483,500	1923	3,592,500
1913	2,753,400	1924	3,536,600
1914	2,716,900	1925	3,567,700
1915	2,607,700	1926	3,504,700
1916	2,808,000	1927	3,498,200
1917	3,104,600	1928	3,449,100
1918	3,508,400	1929	3,444,000
1919	4,169,100	1930	3,407,600
1920	5,110,800	1931	3,298,000

What happened to union membership since 1931 is best described in a recent issue of *Time* which tells of the career of William Green and says that in the days before NRA the membership in good standing was crowding down close to the two million mark.

For the purpose of this discussion, let us take Wolman's figure of forty three million working people in 1923, low for 1933 of course, and give them the benefit of three million members now—about what gain over *Time's* two million figure the NRA may have helped them to—and we have a seven per cent tail wagging a ninety-three per cent dog.

It is time some strong voice was raised for the man who is non-union from principle—the man who wants the benefit of his own initiative, and energy, and skill, and who does not see why he should work for ten cents an hour less than he is worth so wages can be leveled out and some dumb loafer can get ten cents an hour more than he is worth.

The only voice now for him is the voice of the employer and that representation is, of course, regarded with suspicion—no matter how little reason there is for suspicion.

The very fact that he is not organized means that he has no mouth piece unless some public man or men will take up his case and defend his interests.

I repeat—it is time that the fact that union labor is only seven per cent of labor, and stands for nothing the other ninety three per cent want, and is opposed to the American idea of opportunity and hope of betterment of the individual, and is not representative of labor, should be presented to everyone in this country.

There are too many people—workingmen as well as employers—who think union labor is a large part of labor.

Beryllium Copper Is Hard to Cut

Anyone who has tried to turn pure copper knows what a mean sort of a job it is. It isn't very hard but it's a real job to turn off much metal in a reasonable length of time. Now they are adding beryllium and making matters even worse. For while it seems to lose some of its clinging characteristics, it is so hard that ordinary tools have a hard time of it and even the best of tools have their feed cut to about one-half that for steel. And when it comes to reamers it seems that nothing but T-C blades give really satisfactory results. But it is a beautifully dense metal that takes a finish that is pleasing to see, especially when rolled with a glorified tube expander type of tool.

EDITORIALS

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K. H. CONDIT F. H. COLVIN
EDITORS

The Why of the Merit Clause

NRA IS AT THE CRITICAL POINT. It has succeeded in putting men back to work, but not enough of them. It has not generated the enthusiastic public support essential to the Blue Eagle—PRA effort. Strikes, most of them unnecessary and unreasonable, are undoing much of the good work that has been done.

. . . IF IT FAILS, which would be a major catastrophe, the principal reason will be lack of understanding on the part of its sponsors—lack of understanding of the difference between public psychology in time of war and public psychology in time of peace. And lack of understanding of the deep-seated aversion to union domination on the part of almost all employers, and the majority of the native American workers.

. . . WHEN THE RECOVERY ACT was being debated the great mass of unorganized labor was unrepresented and industrial leaders were too busy fighting red ink to take effective measures to head off the one-sided labor clause written into the Act by union leaders. Too late the dangerous potentialities of this clause were recognized, and then followed the struggle to insert the "Merit Clause."

. . . SOME SAY that the merit clause is needless, that nothing in the Act prevents an employer from promoting on merit. If so, why is organized labor so insistent that a statement that an industry proposes to continue this policy shall not be written into any code?

. . . EMPLOYERS are fighting for the clause because they know the utter impossibility of building up morale and maintaining efficiency with a force made up of men who recognize the futility of ambition in the face of the leveling action of union control.

. . . GIVE THE GOOD WORKMAN, the man with skill and energy, the assurance that the exercise of those qualities will advance him. A few employers have denied it to him. They are the ones who chisel at the expense of their employees. A merit clause in a code will force them into line, and will protect the great majority of employers who are more than willing to give every man the proper reward for his effort.

. . . UNION LOBBYISTS wrote into NRA a clause that opens the door to labor racketeering. Let's not forget that thousands of well-organized racketeers will be searching for new rackets after repeal of the 18th Amendment. The merit clause will do much to close that door.

. . . PRESIDENT ROOSEVELT told the American Legion that class and sectional preferment have no place in the New Deal. Speaking to the American Federation of Labor several days later he made an equally strong general statement on the same subject. His only specific observation was that it is not a time for strikes. But he would be a dull listener indeed who did not interpret the President's words to mean that labor racketeering, misrepresentation of the labor clause in NIRA, and any other moves to pervert the Act are equally out of order.

Ploughing Machinery Under

A prominent machine-tool builder wants to know why it would not be entirely consistent for the Government to buy and scrap the existing large stock of second-hand machinery. How would such a program differ in principle from the plan of reducing farm surplusses by ploughing cotton under and lessening the acreage planted to wheat?

If the object of NRA is to add to payrolls, the purchase of new machines, equivalent in capacity although not in numbers of units to the second-hand ones that might be used, would put many men back at work in the equipment industries. Transfer of a used machine from dealer's warehouse to customer's floor, on the contrary, leads to little employment, except for a repair man or two.

Government money, spent in this way, would be far more effective in hastening recovery than that given to farmers for reducing acreage. It would be effective in breaking the jam in the capital goods industries that is blocking everything else. Remember, for each man who goes back to work on capital goods, three men are re-employed on consumer goods, transportation and distribution.

An additional advantage from such a policy, if it led to modernization of obsolete plants, as it surely would, would be the lowering of costs of production and selling prices to the consumer, and the providing of profits for the manufacturer. If there are no profits and no dividends where will the taxes come from that are to pay for our huge recovery investments?

• CHIPS •

Washington—Government rail-buying plan expanded to include railway rolling stock . . . Arrangements for taking over surplus stocks of foods to be distributed through relief committees continue . . . President goes to Chicago to tell American Legion that Washington recognizes responsibility of relief and hospitalization for war disabilities only . . . Legion votes down bonus plea . . . Roosevelt tells Britain, through Ambassador-at-large Davis, that U. S. will not stop building 10,000-ton cruisers . . . Senator Copeland asks increase in Federal Bureau of Criminal Investigation to establish an American "Scotland Yard" . . . American Federation of Labor against inflation and Soviet recognition . . . NRA being reorganized to handle third stage of program—administration of codes.

Foreign—Latest of many hurricanes to strike eastern coast devastates Tampico, killing more than 50 . . . Soviet officials order German news reporters out of Russia and withdraw Soviet correspondents from Germany . . . British industry recovered in August as indicated by 13.7 per cent increase over August, 1932, electricity output figures . . . Boycotts force Nazis to modify anti-Jewish campaign centered on department stores . . . French import quotas, set for one month, increase U. S. figures for gears, drills, taps and dies by 14 times, at expense of Germany . . . Cubans riot in Havana as officers surrender . . . Hindenburg celebrates eighty-sixth birthday . . . British automobile registrations for first nine months of 1933 establish record . . . Chancellor Dollfuss of Austria shot by ex-soldier, not seriously hurt.

Finance—Comptroller of the Currency directs receivers of closed banks to submit lists of mortgages that might be exchanged for Home Loan bonds . . . Federal Reserve Board reports 30 per cent gain in velocity of turnover of deposits in July as against March . . . Secretary of State Hull deputizes Assistant Secretary of the Treasury Acheson to open debt settlement conversations with British representatives . . . Administration planning to spend $700,000,000 to help banks meet terms of deposit guaranty law . . . First gold-hoarding case approaches hearings stage . . . Reserve Banks step up open market operations . . . Henry Bruere appointed to coordinate credit activities of government . . . Senate stock market inquiry resumes with Clarence Dillon, of Dillon, Read, on the stand.

Industry—4,000 workers in Ford's Chester (Pa.) assembly plant walk out in protest against 32-hour week at $16, ask for 5 days at $25 . . . Plant shut down, possibly permanently . . . Trouble spreads to Edgewater (N. J.) plant . . . Tool and diemakers in Detroit, members of an independent union, strike for recognition and $1 to $1.50 per hour . . . Conference Board figures show 8.6 per cent increase in employment during August, average hourly rise in earnings—9.2 per cent, drop in working time—8.9 per cent . . . Labor renews demand for 30-hour week . . . Ford shifts from 4-day, 32-hour week with intermittent 40-hour operation for average of 35 hours to 5-day, 40-hour week with shutdowns to bring down the average to 35 . . . Railroads start buying rails, pledge 250,000-ton orders . . . Lackawanna adds to locomotive order . . . Pennsylvania announces store-door delivery service . . . Other roads to follow suit.

Trade—Railroads consider reduction of passenger fare, abolition of Pullman surcharge, issuance of mileage books in fight against bus and plane transport . . . Recovery of trade indicated by first increase in commercial loans since 1929 . . . New York department stores report that they are handling only such German goods as are not available elsewhere . . . Shippers estimate fourth quarter carloadings 15 per cent over 1932 . . . Fourth quarter minimum prices of merchant bars filed with American Iron and Steel Institute mark advance of $3 a ton.

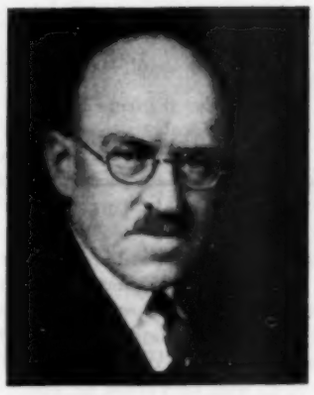
Flanders Presents Machine Tool Code to NRA

Washington—Only two hours was consumed at the public hearing of the code of fair competition for the machine-tool industry, held October 2, under the direction of Deputy Administrator Malcolm Muir. Written briefs contained most of the evidence submitted.

Ralph E. Flanders, code chairman of the National Machine Tool Builders Association, and president of the Jones and Lamson Co., presented the code. In reading his letter of transmittal, Mr. Flanders pointed out some of the difficulties the industry has experienced. Among these are the extreme cyclical fluctuations to which machine-tool activity is subject and the loss of export business that formerly lessened the severity of depressions. He stated that owner-management, to a large extent prevailing in the industry, has promoted good will and cooperation between employers and employees. Many machine-tool companies have followed a policy of providing work for their employees by the development of new designs, said Mr. Flanders.

Attention was drawn to the fact that the depression had caused the greatest amount of unemployment in the capital goods industries, by John W. O'Leary, president of the Machinery and Allied Products Institute with which the N.M.T.B.A. is affiliated. He pointed out that, whereas durable goods represented a capital volume in 1929 of 40 billion dollars compared to 30 billion dollars of consumer goods in 1932, there had been a decline of 52 per cent in consumer goods volume as compared to an 80 per cent drop in durable goods. Thus, said Mr. O'Leary, the greatest opportunity for reemployment lies in the capital goods industries which have suffered the greatest losses.

Mr. O'Leary also emphasized the need for credit expansion for long terms because capital goods are bought with savings rather than income. An estimate was submitted that only $250,000,000 would be made in long-time credits for the purchase of capital goods in 1933 as compared with the corresponding 1929 figure of $8,000,000,000. Setting hourly wages too high, working hours too long Mr. O'Leary contended might retard reemployment by boosting costs to high and so defeat the purpose of the code.



Ralph E. Flanders

Mr. Muir asked for information on the estimated number to be reemployed under the schedules submitted by the code and also on the comparison between present hours and wages and those prevailing in 1933. Elimination of paragraph 2, 3 and 4 of Section XIV relative to changes in published prices was requested by the consumer advisory board. These may be referred to in the code text (*AM*—Vol. 77, page 564a).

No mention of the controversial "merit" clause was made during the public hearing. It is understood, however, that objections were made at informal preliminary hearings and that these were contained in briefs filed by labor representatives. Another objection is said to be in regard to the hours per week specified in the code which labor leaders contend is too high to reabsorb many of the unemployed in the industry. However, it is understood that leading members of the industry are determined to take a firm stand on these points.

Mr. Muir complimented the industry on the cooperation given the NRA and the spirit and intelligence displayed.

Britton Appointed Dealers Advisor

A recent announcement by Edward R. Stettinius, Jr., liaison officer between the Industrial Advisory Board and the National Recovery Administration, told of the appointment of Mason Britton, vice-president, McGraw-Hill Publishing Co., as industrial advisor on codes for the machine tool dealers. John H. Goss, vice-president, Scoville Manufacturing Co., was made advisor for the fabricated metal products and metal finishing and coating industry.

Other new appointments were: George Heintzman, Dexter Folder Co., for the printing equipment industry; Carl G. Bingham, Samuel Bingham & Sons Co., for the printers' rollers industry; and W. R. Bean, vice-president, the Whiting Corporation, for the malleable iron industry.

• INDUSTRIAL REVIEW •

Strikes and labor unrest, brought about by misinterpretation of the labor clause in the National Industrial Recovery Act, are slowing down the market for machinery and machine tools. Manufacturers who have a strike on their hands, or who are anticipating one, are not interested in buying equipment On the other hand, considerable business is likely to be placed as soon as the labor situation is cleared up.

October opened in the East, as reported by machinery men in Boston, New York and Philadelphia, with little change. A few orders are coming in and there is some encouragement in the fact that there has been no appreciable drop. Pittsburgh is in the grip of labor agitation and the results may be serious if companies decide not to continue their welfare work which kept many a worker's family together last winter.

In Cincinnati, labor troubles and codes are retarding sales. Machinery men there feel that recovery would have been well advanced if there had been no paragraph 7 (a) in NIRA. No change of any moment is reported from Cleveland, while Detroit is marking time until the toolmakers end their strike. A few machine tool orders are reported in spite of the labor situation.

Votes have been taken in several important Indiana plants to determine whether the employees are to have their own organization or join a national union. Most of the votes were for company groups. Inquiries and orders are better than for several months. St. Louis is slow, thanks to strikes and apprehension. Small tool and supply orders also dropped. In Chicago labor troubles have not been so serious but orders have been few. Labor agitators are active in Milwaukee and are making some progress. Orders are infrequent.

Code Hearings Scheduled

Date	Place	Deputy Administrator	Association
Oct. 11	Carlton Hotel	Malcolm Muir	Packaging Machinery Manufacturers Institute
Oct. 11	Carlton Hotel	Malcolm Muir	Canning and Packing Machinery Institute
Oct. 11	New H. O. Building	Malcolm Pirnie	Metal Window Institute
Oct. 12	Raleigh Hotel	Malcolm Muir	Paper Machine Builders
Oct. 13	New H. O. Building	H. O. King	Non-Ferrous Ingot Metal Institute
Oct. 14	New H. O. Building	Malcolm Pirnie	Rolling Door Institute
Oct. 19	Willard Hotel	H. O. King	Gas Appliance Institute

AMPA Holds Meetings In Three Cities

Meetings of the newly formed American Machine and Parts Association were held in Boston on October 2, New York on October 3 and Cincinnati on October 4. W. J. Kelly, president, outlined the function of the association in providing an organization for manufacturers who did not logically belong to a more specific group.

H. E. Christiansen, representing the Machinery and Allied Parts Institute, with which AMPA is affiliated, explained the progress of the institute.

Manufacturers of Screw Machine Products Organize

At a recent meeting held in Buffalo, the National Screw Machine Products Association was formed. Membership is confined to manufacturers of products which can be made on single or multiple spindle automatic or hand screw machine equipment.

Officers selected at the meeting, which was attended in person or by proxy by 146 manufacturers, were as follows:

President—David Bell, The Bell Co., Inc.

Vice President—George Briggs, Screw Machine Products Corp.

Secretary—C. C. Heath, The Brown-McLaren Co.

Treasurer—E. A. Schneider, Hudson Screw Machine Product Co.

Directors in addition to the officers:

R. T. Frisbee, New Britain Machine Co.

L. H. Jockmus, Ansonia Manufacturing Co.

William Finn, Chicago Screw Co.

G. H. Wayne, Scoville Manufacturing Co.

It is estimated that the total number of manufacturers eligible for membership is close to 300, having in normal times a yearly sales output of $30,000,000. The association was formed to cooperate with the Washington administration in the execution of the NIRA. It has already been accepted for membership in the Fabricated Metal Products Federation.

Used Machinery Dealers To Meet Again

At the Cleveland meeting of the National Institute of Used Machinery and Equipment Dealers, on September 30, the following were appointed a steering committee to urge the forming of local groups: T. F. Donohue, (chairman) Donohue Steel Products Co., Chicago; E. Scheel, Humphrey, Prentke & Scheel, Cleveland; M. D. Galbreath, Marr-Galbreath Co., Pittsburgh; F. O'Brien, Jr., O'Brien Machinery Co., Philadelphia, and S. A. DeWitt, DeWitt Tool Co., New York City.

The next meeting will be held in Chicago, Oct. 21, place to be announced later.

Machine Tool Dealers To meet in Washington

President William K. Stamets of the Associated Machine Tool Dealers has announced a meeting of this association to be held in Washington on October 25, 26 and 27. On October 26 several hundred machine tool builders and dealers have been invited to participate in a joint meeing which will be addressed by Malcolm Muir, Deputy, Administrator, NRA. This meeting will be held in the West Ballroom of the Shoreham Hotel at 10 a.m.

President Approves More Metal-Working Codes

To speed up the operation of the NIRA, President Roosevelt recently affixed his signature to seventeen new codes of fair competition, five of which are in branches of the metal-working industry. These five cover manufacture of steel boilers, knitting braiding and wire manufacturing machinery, textile machinery, laundry and dry cleaning machinery, and farm equipment.

With the exception of that for laundry and dry cleaning machinery, which specified a 36-hour week, these codes called for a maximum of 40 hours. Minimum wages were set at 40 cents an hour except for the textile machinery code which called for 35 cents, with the customary exceptions for learners. The farm equipment code called for a 10-cent lower level in the southern states and 35 cents an hour in other communities having a population less than one million. The boiler code also includes a regional differential with a 34 cent minimum in the South.

Wages for office workers on textile machinery are to be $12 to $15, $15 in boiler manufacturing and $14 for textile machinery and knitting, braiding and wire covering machinery.

British Permit Cost-Reducing Machine Imports

London—Although Great Britain is making every effort to exclude, by tariff, manufactured goods the import of which restricts employment, the authorities are alive to the advantage of using manufacturing machinery that will operate to secure higher or better-quality output at lower cost. Consequently, the Import Duties Advisory Committee recently decided to issue licenses for the free importation of machines not available in the United Kingdom for manufacturing metal goods, agricultural products, batteries, textiles, glassware, radio tubes, electric lamps, soap, paper and board, castings, brushes, matches and other products.

Machinery for such purposes will come in large part from the United States, but an incorrect impression of international trade movement will be gained if the expenditures on such imports into the United Kingdom be compared with imports of British manufactured goods into the United States. The eastward movement is a temporary one, designed eventually to effect independence from certain imports, to permit successful competition in world markets.

Industrial Self Government Provided by NIRA

Muir tells machinery dealers that plants must modernize to offset increased costs

"Some people feel that the Blue Eagle Campaign is mere ballyhoo. It is not. It has a definite purpose and a logical place in the whole NIRA program," Deputy Commissioner Malcolm Muir told the Triple Mill Supply Convention at the Wardman Park Hotel, Washington, on September 26, 1933. This meeting was attended by representatives of the National Supply and Machinery Distributors Association, the Southern Supply and Machinery Distributors Association, and the American Supply and Machinery Manufacturers Association.

Mr. Muir continued:

"Industry is being rapidly codified and the administration factors of the program are moving forward to completion. I find other plans in Washington which will be a great help to prosperity such as the study of ways and means of assisting the capital goods industries both by stimulating their purchasing and also the financing of such goods. Also the development of the public works program and other similar plans.

MALCOLM MUIR

"NRA is alert to the need for stimulating buying in the capital goods industries. It is unfortunate that, in the confusing, early days of NRA, the idea was allowed to get abroad that no new machinery was to be bought by industry. Since then, soberer analysis has shown that unless we have recovery of the capital goods industry, we shall have no real general recovery.

"Since the middle of March, 1933, we have had one of the fastest, if not the fastest, rise of the business curve this country has ever known. The only worry is—to what extent will it continue without the recovery of the capital goods industry? Consumers' goods reached a low, last March, of 26 per cent off the 1929 peak, and since March has recovered *nearly half* of that loss. You know how that was done. The shelves of wholesalers and dealers were empty and, fearing, in fact knowing, that prices were going up, they bought fast and furiously. Their enormous orders brought about a 48 per cent rise in the manufacture of consumers' goods. Now the question is, will those goods go from the warehouses and the dealers' shelves into the hands of the public? Up to recently, statistics indicated that retail sales have increased only 12 per cent, whereas, as we have said, manufacturing has increased 48 per cent.

"Perhaps the reason for that lag lies in the fact that the capital goods industry which had fallen *two-thirds* below its 1929 peak (compare that with the 26 per cent drop of the consumers' goods industry) has come back only one-fifth of the way, and so has re-employed a correspondingly small number of workers. In 1929, the capital goods industry (and those producing material and services entering into both capital and consumers' goods) employed approximately 10,000,000 workers or one-half the number of workers employed by the consumers' goods and the capital goods industries. In view of that, could anyone doubt the patriotism of the plant that modernizes its plant and replaces its old machinery—or the patriotism of the manufacturer who sells to it?

"Now that many industry codes have been accepted, manufacturers with low cost plants are happy. They find they have an economic advantage. Keep in mind that the NIRA codes prohibit an individual manufacturer selling below *his own* cost—but not below his competitor's cost. So the low-cost plant can use this economic advantage several ways—might even sell at the same price as its competitors and use the extra profit for more salesmen, for redesign of products, for improved quality.

"On the other hand, if the high-cost plant, which has agreed not to sell below its own cost, too, refuses to see the advantage of using modern up-to-date machinery, continues to tolerate obsolescence, determines to retain high costs, that is virtually a decision to commit commercial suicide. Now suppose you persuaded this plant to modernize, to construct a new efficient plant, to install modern equipment and methods, to reduce costs to competitive levels. Then this plant could survive, then it could continue to provide employment and could continue to contribute to the economic and social welfare of its community. In addition, this plant would be helping to revive the prostrated industry of capital goods—would be doing its share of putting the 10,000,000 workers normally employed in the capital goods industry back to work.

"As I view the new deal under the NRA, the biggest handicap to business, namely, 'profitless selling' is out of the window, never I hope to return. All of the ingenuity, which has brought about our present civilization, of laboratory, design room and invention will have free play to supply the new wants and new needs of the great masses of new purchasing power being created."

Australian Tractor Market More Favorable

With the depreciation of the American dollar and a disappearance of the "back-to-the-horse" movement, the outlook for the sale of American tractors in Australia has brightened considerably. Already sales for the first months of 1933 amount to more than for the entire year of 1932. Twelve wheel-type and 42 tracklaying tractors, with accessories, valued at $51,800, were imported from the United States in the first half of this year. Fourteen wheel and sixteen tracklaying American tractors valued at $51,778 were shipped into Australia last year.

A great increase in sales could be made if proper financing were arranged. At the present time, banks are disinclined to finance farmers for tractor purchases, although they will finance them for horses. However in Western Australia, the state government has given farmers assistance in the purchase of kerosene.

Stocks of repossessed tractors still remain in the Australian market, but the coming harvest should pretty well clean up this used stock. Development of the diesel engine is being watched because of the low fuel cost. It also seems likely that banks will change their attitude should it be possible for farmers to purchase practical diesel tractors at reasonable prices.

Phillips Named to Head Steel Treaters

Detroit—Nominations made at the National Metal Congress, on October 3, for 1934 officials of the American Society for Steel Treating include the following:

President—W. H. Phillips, Molybdenum Corporation of America

Vice-president—B. F. Shepherd, Ingersoll-Rand Co.

Treasurer—A. T. Clarage, Columbia Tool Steel Co.

Directors—E. C. Bain, United States Steel Corporation; W. P. Woodside, Climax Molybdenum Co.

Detroit was a much conventioned city during the week of October 2, with the American Welding Society, the Wire Association, the American Society of Mechanical Engineers and two divisions of the American Institute of Mining and Metallurgical Engineers meeting in addition to the Steel Treaters.

Among the many outstanding papers of interest to metal workers (See program, *AM*—Vol. 77, page 628e) was "Simplicity—the Solution of Extreme Accuracy in Quantity Production" by Gordon M. Evans, vice-president, the Kelvinator Corporation, given at the A.S.M.E. session. Professor O. W. Boston and W. W. Gilbert, University of Michigan, contributed a concise and illuminating paper on "The Life of Turning Tools Influenced by Shape." Clear cut designation of terms used regarding cutting angles, rakes and clearances were given in a diagram that may be followed in future tests to standardize results.

In the Campbell Memorial lecture, H. J. French, metallurgist for the International Nickel Co. gave an appraisal of the process of martensitization and age hardening from the results of an exhaustive research.

Two papers dealt with problems in the manufacture of stainless steel. One, entitled "Some Factors Affecting the Physical Properties of 18.8 Steel Wire" by W. H. Willis and J. H. Findley, Ludlum Steel Co., gave methods of stabilizing this alloy by heat treatment at 1500 F. for various lengths of time and by the addition of titanium. The other stainless paper "The Action of Oxygen and Hydrogen Sulphide Upon Iron—Chromium Alloys at High Temperatures" by R. L. Rickett and W. P. Wood, University of Michigan, showed that in general that hydrogen sulphide cause greater scaling than oxygen.

Other papers of particular interest were "Heat-Treatment of Cast Iron" by Carl H. Morken, Detroit Electric Furnace Co.; "Present Status of Age Hardening" by Richard H. Harrington, General Electric Co.; "An Aircraft Manufacturer's Experience with Welding Quality Control" by T. H. Speller and P. N. Jansen, Curtiss Aeroplane & Motor Co. (abstracted on page 651 of this number); and "Shop Set-Up for Pre-Fabrication of Welded Machinery" by R. R. Kendal, Wickes Boiler Co. These last two were presented before the A.W.S.

Metals in great variety headed the list of exhibits in the Fifteenth National Metal Exposition. Die castings of zinc, bronze and aluminum formed the subject of outstanding displays. Stainless steel in both bright and dull finishes exemplified the possibilities of this material. Furnaces fired with gas, oil and electricity and their control instruments were much in evidence. Welding machines, two metal spraying outfits and testing equipment rounded out the comprehensive offerings of 130 exhibitors.

Argentina Buys More Farm Equipment

For the first half of 1933, Argentina increased its imports of agricultural implements and parts by 64 per cent compared to last year. Customs value reached 529,932 gold pesos as against 322,442 pesos for the same period in 1932. (Argentine gold peso = $0.965.)

Plowshares, the most important item, increased 152 per cent or 754,000 lb. Commerce department figures show only four tractors imported during the first half of 1933, but it is estimated that up to August 15 between twelve and fifteen had been received into the country. Most of these were of the heavy tracklaying type and three were diesel equipped.

August Auto Exports At Year's High

With gains of 7 per cent over July and 49 per cent over August 1932, exports of automotive products during August, valued at $8,327,485, formed the highest monthly total this year. This was the first instance since 1928 when August figures surpassed those for July.

Another indicator of the trend in overseas trading is that, whereas for the first half sales of automotive products were 12 per cent below 1932, those for the first eight months lagged by only 3 per cent.

Passenger car exports rose from 2,839 valued at 1,565,469 in 1932 to 6,447 valued at $3,215,917 in 1933. In the same period, truck shipments increased from 2,035 valued at $883,959 to 3,772 valued at $1,701,508.

The Union of South Africa and Belgium represented the leading markets for American passenger cars, followed by the Netherlands, British India and Japan. Japan was the chief purchaser of American trucks followed by Spain, British India, and Belgium in the order named.

Implement Imports Increase; Exports Drop

Imports of agricultural implements into the United States were valued at $82,936 for August as against $40,234 in August, 1932 and $156,781 in July. With the exception of 1,000 cream separators from Sweden, the bulk of the imports consisted of unclassified implements and parts of which the United Kingdom supplied $25,703 and Canada $15,784.

Exports for August fell to $836,536 from 1,183,944 for August last year. The bulk of foreign shipments consisted of 151 wheel tractors and 85 tracklaying tractors valued at $454,218. Canada was the largest market for American implements taking $245,900 worth of equipment while the United Kingdom was second with imports of $63,564 chiefly tractors. The Union of South Africa, with purchases amounting to $59,013, was third.

Kohl Elected to Head Tool Institute

Officers elected to govern the recently formed Special Tool, Die & Machine Shop Institute, include the following:

President and Treasurer—J. J. Kohl, International Tool Co.

Vice-president—H. A. Stoddard, Interstate Mechanical Laboratories.

Managing director—Roy T. Wise.

A code of fair competition filed by the institute will soon be available from the Department of Commerce. Mr. Wise is located at 7016 Euclid Ave., Cleveland, Ohio, and has available a pamphlet containing articles of incorporation and by-laws of the institute for those interested.

Plans are being formulated to correct the many abuses prevalent in the industry.

Exports of Machinery During August, 1933

	August, 1933	July 1933	August, 1932
Electrical machinery	$3,561,785	$3,150,456	$2,423,656
Power generating machinery (except electric & automotive)	366,941	322,006	299,832
Construction machinery	300,119	232,181	306,686
Mining, well, & pumping machinery	1,189,295	780,964	797,863
Power-driven, metal-working machinery	825,104	465,702	992,903
Other metal-working machinery	116,538	68,826	139,972
Textile machinery	402,940	468,889	605,328

Exports of Metal-Working Machinery During August, 1933

	August, 1933	July, 1933	August, 1932
Engine lathes	$24,254	$11,803	$46,741
Turret lathes	28,035	13,157	.....
Other lathes	9,246	12,228	19,136
Vertical boring mills and chucking machines	10,920	10,045	16,096
Thread-cutting and automatic screw machines	29,595	22,135	10,880
Knee and column type milling machines	65,615	6,543	47,436
Other milling machines	26,231	12,741	59,437
Gear-cutting machines	78,614	51,336	28,995
Vertical drilling machines	46,192	38,683	1,546
Radial drilling machines	5,553	8,694	.....
Other drilling machines	20,618	18,008	1,466
Planers and shapers	22,488	1,150	4,222
Surface grinding machines	8,409	4,060	9,256
External grinding machines	36,858	3,998	37,745
Internal grinding machines	20,400	12,360	17,236
Tool grinding, cutter grinding, and universal grinding machines	27,090	19,568	18,545
Other metal-grinding machines	22,359	19,624	17,571
Sheet and plate metal-working machines	90,989	37,640	495,438
Forging machinery	28,253	34,118	7,881
Rolling mill machinery	63,658	23,913	1,197
Foundry and molding equipment	23,340	11,400	18,600
Other power-driven metal-working machinery and parts	136,387	92,228	133,470

Other Metal-Working Machinery

Pneumatic portable tools	47,729	19,853	17,939
Other portable and hand or foot operated metal-working machines and parts	33,076	17,309	16,510
Chucks for machine tools	5,417	3,920	3,294
Machine-operated pipe and thread cutters, stocks, dies, taps, and other machine-operated tools	17,775	16,320	89,755
Other metal-working machine tools	12,541	11,424	12,474

N.E. Council Surveys NIRA Results

A study recently made by the New England Council reflects the effect of the NIRA on New England industry. Direct statements by executives give material for a factual appraisal of managements' problems under the New Deal.

Typical among the replies is one from a manufacturer of steel tools and allied products:

"Results of NRA plus threats of inflation on our business are as follows:

1. Employment—increased 20 per cent in numbers.
2. Payrolls—last three months over the first three months increased 100 per cent.
3. Labor relations—individual bargaining same as the last 20 years.
4. Cost—increased 10 per cent.
5. Prices—increased 10 per cent.
6. Sales—increased 125 per cent.
7. Profits—1st quarter—minus
   2nd quarter—plus
   1st half—plus
   last three months profits satisfactory for the first time in three years.
8. NIRA changes—July 31, 1933 adopted 40 hour maximum per employee week; minimum pay 35 cents male adults; 30 cents female.
9. Two separate pay advances salaries employees since June 1, 1933.
10. Operating five days per week.
11. All employees getting more money than six months ago. Higher paid employees getting more money than six months ago but less money per week in August compared with June and July. All hour employees advanced in rate.
12. Orders fallen off 25 per cent in volume last three weeks compared with previous six weeks.

"We have the Blue Eagle and are operating under the Blanket Code and have filed application for several different codes. If all were accepted we would operate under seven different codes. We are enthusiastic for the plan as a temporary expedient, but much against it, and believe it would be a failure, if carried on too long. We are strenuously opposed to any tendency toward the closed shop and shall continue to be to the best of our ability."

Roos Nominated for S.A.E. Presidency

Officers and members of the council of the Society of Automotive Engineers nominated for 1934 are as follows:

President—Delmar G. Roos, chief engineer, Studebaker Corporation.

Vice-presidents:

Aircraft—T. P. Wright, general manager, Curtis Aeroplane & Motor Co.

Aircraft Engines—Robert Insley, research engineer, United Aircraft & Transport Corporation.

Diesel Engines—H. D. Hill, vice-president and general manager, Hill Diesel Engine Co.

Fuels and lubricants—A. L. Clayden, research engineer, Sun Oil Co.

Motor trucks and motor coaches—A. K. Brumbaugh, commercial engineer, White Motor Co.

Passenger cars—F. F. Kishline, assistant chief engineer, Graham-Paige Motors Corporation.

Passenger car bodies—John W. Votyka, chief engineer, Le Baron-Detroit Co.

Production—W. H. McCoy, manager, Experimental Production Machine Shop, General Motors Corporation.

Transportation and maintenance—L. V. Newton, automotive engineer, Byllesby Engineering & Management Corporation.

Councilors—J. M. Crawford, chief engineer, Chevrolet Motor Co.

J. B. Fisher, chief engineer, Waukesha Motor Co.

J. F. Winchester, coordinator and supervisor of equipment Standard Oil Co. of N. J.

Treasurer—David Beecroft, manager N. Y. Office, Bendix Aviation Corporation.

DELMAR G. ROOS

Since his graduation from Cornell University in 1911, Mr. Roos has been continuously connected with the automobile industry. He served the Locomobile Co. of America in various capacities until 1925 when he resigned his position as vice-president to become chief engineer of the Marmon Motor Car Co. Later he became chief engineer of the Studebaker Corporation.

For many years Mr. Roos has been prominent in S. A. E. work and served as vice-president in charge of passenger car work in 1932. He has served at various times on such important committees as the Military Motor Transport Advisory committee, the Stock Car Contest Advisory committee and the Ordnance Advisory committee.

Stout to Tell of New Railcars

At the first fall meeting of the Metropolitan Section of the S.A.E., to be held October 19, at 40 East 41st St., New York City, William B. Stout, president, Stout Engineering Laboratories, Inc., will discuss automotive railcars. An inkling of the radical departures that are to be included may be gathered from Mr. Stout's statement at the recent Metal Congress that although the Stout railcar is 60 ft. long and 10x10 ft. in cross-section, it weighs, without windows, only 5,400 lb.

• PERSONALS •

EVANS WARD has been elected president, and continues as general manager, of the Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y., to succeed the late WILLIAM WARD. WARREN L. WARD has been made vice-president.

DAVID FINDLAY, general sales manager of the L. S. Starrett Co., Athol, Mass., was elected vice-president on Sept. 20, but will continue to serve also as general sales manager.

H. F. SEYMOUR, president of the Columbian Vise & Mfg. Co., Cleveland, has been re-elected president of the American Supply & Machinery Manufacturers' Association.

•BUSINESS ITEMS•

The firm of Julius Klein & Associates has been organized by JULIUS KLEIN, former Assistant Secretary of Commerce, and CLARENCE B. HURREY, who has collaborated with Secretary of Commerce Roper in handling taxation matters. With a group of experts the organization will serve as Washington representative for associations and larger industrial and commercial units on problems involving NRA contracts and other Governmental activities and policies of primary concern to business.

The assets of the Jamestown Screen & Mfg. Co., Jamestown, N. Y., have been acquired by AXEL E. ECKBERG, president of the Alliance Furniture Co., of the same city, and the company will be reorganized and continue production.

The air-cooled engine business formerly conducted by Doman & Marks, Syracuse, N. Y., will be continued by the Doman-Marks Engine Co., Amesbury, Mass.

The Falk Corp., Milwaukee, Wis., has appointed FITCH S. BOSWORTH, 5475 Cabanne Ave., St. Louis, Mo., as representative for its entire line of products, to succeed T. F. SCANNELL who has been transferred.

• OBITUARIES •

Charles Piez Dies; Link-Belt Chairman

Charles Piez, chairman of the board, Link-Belt Co., Chicago, director general of the Emergency Fleet Corp. during the War, and a past president of the American Society of Mechanical Engineers, died in Washington, D. C., on Oct. 2. Mr. Piez was 67 years old. While pneumonia was the direct cause of his death, his health has been failing for the past five years, and since February, 1932, he had been inactive in business.

Mr. Piez entered the employ of the Link-Belt Engineering Co., Philadelphia, as an engineer-draftsman in 1889, and later became chief engineer and general manager. In 1906, he was elected president of a consolidated organization of the three related companies, the Link-Belt Machinery Co., Chicago, the Ewart Mfg. Co., Indianapolis, and the Link-Belt Engineering Co., Philadelphia.

During the War, Mr. Piez was selected by Edward N. Hurley, then chairman of the United States Shipping Board, to be vice-president and general manager of the Emergency Fleet Corp. His periods of service as president of the Illinois Manufacturers' Association were from 1911 to 1913 and again from 1924 to 1925. He was a member of the following engineering societies: American Institute of Mining & Metallurgical Engineers; Society of Naval Architects & Marine Engineers; Western Society of Engineers, and Engineers' Society of Northeastern Pennsylvania.

EDWARD G. CAME, 82, president of the J. E. Came Co., Boston, Mass., tool manufacturer, died Sept. 22 after a connection with the company of 45 years.

JOHN CLIFTON HENDERSON, inventor of cast "Nichrome," died Sept. 25 at the age of 56. Mr. Henderson had been consulting engineer for the Driver-Harris Co., Harrison, N. J., for the last twenty years.

NELSON FERGUSON, former president and secretary of the Pittsburgh Block & Mfg. Co., Pittsburgh, Pa., manufacturer of pulleys, forgings and ratchets, died Sept. 26 at the age of 81.

RALPH T. HORNING, 74, retired president of the Ladel Conveyor & Mfg. Co., New Philadelphia, Ohio, died Sept. 23.

E. C. HUNT, secretary and treasurer of the Moline Tool Co., Moline, Ill., died Sept. 21 at the age of 62.

HENRY S. NORTHROP, a founder of A. Northrop & Co., Pittsburgh, metal stamping manufacturer, died Sept. 27 at the age of 76.

T. L. RYERSON, president of the W. D. Allen Mfg. Co., Chicago, died recently.

ANTONIO B. SPENCER, 60, president of the United States Ring Traveler Co., Providence, R. I., machinery manufacturer, died recently in that city.

JACOB M. SPITZGLASS, 64, vice-president of the Republic Flow Meters Co., Chicago, died Oct. 1. Mr. Spitzglass was born in Russia. He was the inventor of an electric device for recording the flow of fluids.

CHARLES E. THOMPSON, 63, president, Thompson Products Inc., Cleveland, manufacturer of valves for airplanes and automobiles, died Oct. 5. He was a founder of the Electric Welding Products Co., Cleveland, in 1901, and also founded the Thompson Trophy Race for land planes.

HORACE P. YALE, pioneer manufacturer of special machinery and dealer in machine tools, died Sept. 30 at the age of 83.

• MEETINGS •

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Semi-annual meeting. October 17-18. Penn-Lincoln Hotel, Wilkinsburg, Pa. J. C. MCQUISTON, secretary, First National Bank Bldg., Wilkinsburg, Pa.

American Machinist
REFERENCE BOOK SHEET

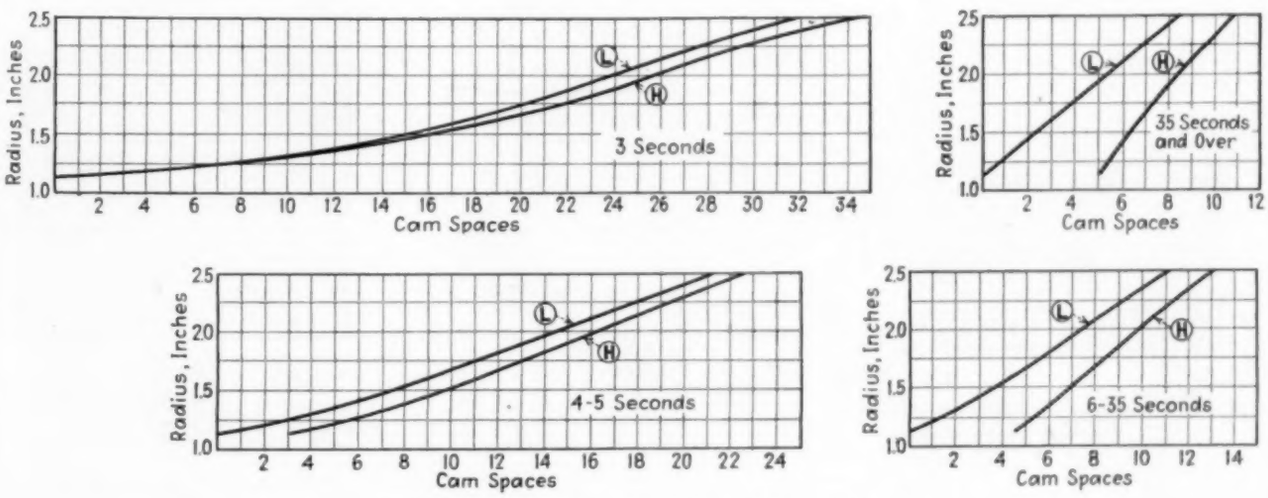
Screw Machine Work

Pullouts for Drills

IN LAYING out a set of cams for the B & S Nos. 00, 00G and 19 automatic screw machines, it is often necessary to have one drill enter the work farther than its recommended depth. So that the job may run without trouble, pullouts are usually provided for in the cams so that the drill can feed in for a distance of three or four times its diameter and then drop back sufficiently to clear the tip to permit the coolant to wash away the chips and cool the drill. The cam then advances the drill to the cutting position and the hole is drilled deeper.

When determining the cam spaces required for pullouts, it has been customary to draw that portion of the cam on either a blank cam or a layout sheet and to count the number of cam spaces needed. To obviate the necessity of drawing up each job the charts shown were developed. The only data needed are height of lobe before the pullout, the lowest radius of the pullout, and the estimated running time of the cycle.

Example: Assume a job running in 15 sec., a height of the lobe before the pullout of 2 in., and that the drill must drop back ½ in. Refer to the chart for a 6-35 sec. cycle. Follow line *L* (lowest radius of pullout) to a radius of 1½ in. The corresponding number of cam spaces is 3½. Follow line *H* (height of lobe before pullout) to a radius of 2 in. The corresponding number of cam spaces is 10. Subtracting *L* from *H* gives 6½ cam spaces, the number required for the pullout.

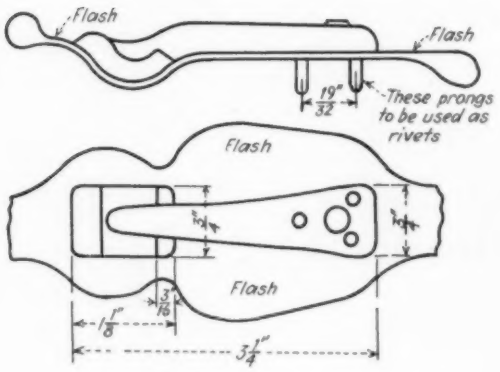


Courtesy of the Banner Manufacturing Company, Inc.

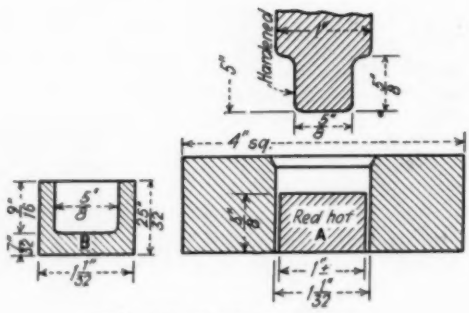
© AMERICAN MACHINIST

Press Work Pressures

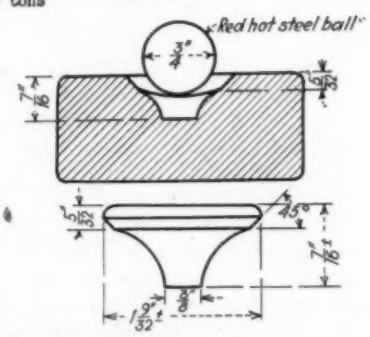
Series XVII—*Forging*



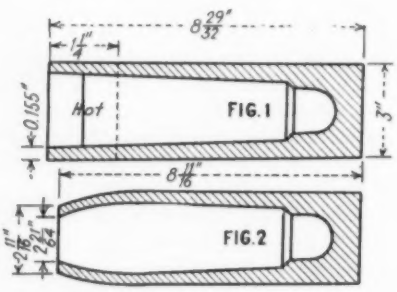
Material--Copper 3-1/2 in. long by 5/8 in. in diameter
Operation--Forge red hot
Pressure--225 tons



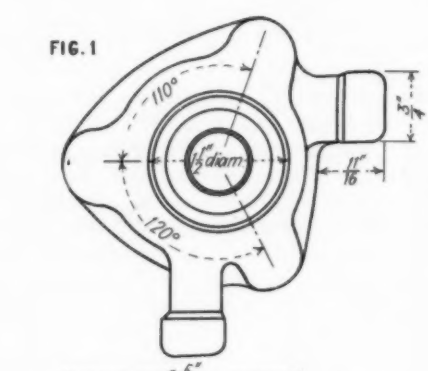
Material--Steel, low carbon
Operation--Form piece B red hot
Pressure--35 tons



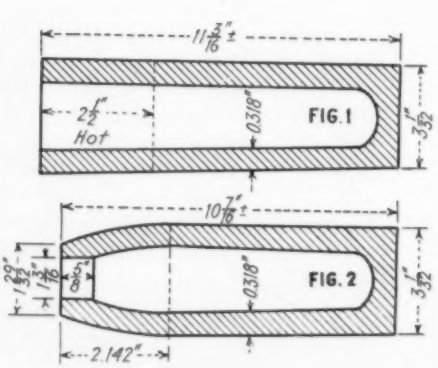
Material--Steel ball, 3/4 in. in diameter
Operation--Forge into valve head while red hot
Pressure--85 tons



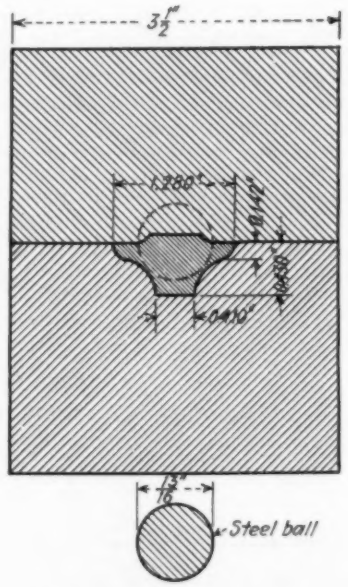
Material--Steel, low carbon
Operation--Nose in a shell, red hot, 1-1/4 in. from the end
Pressure--70 tons



Material--Brass blank, 2 in. in diameter by 1-1/4 in. thick
Operation--Forge hot
Pressure--400 tons



Material--Steel, low carbon
Operation--Nose in a shell, red hot, 2-1/2 in. from the left end
Pressure--150 tons



Material--Steel ball, 13/16 in. in diameter
Operation--Forge into shape while red hot
Pressure--80 tons

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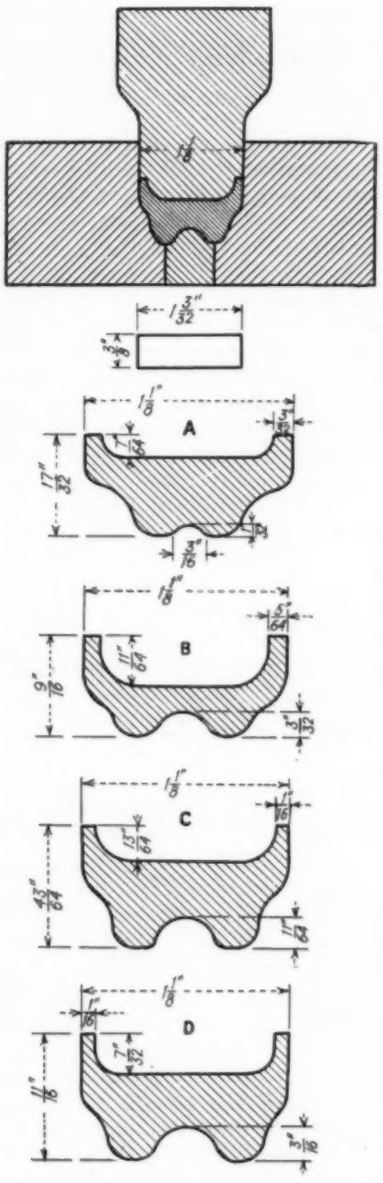
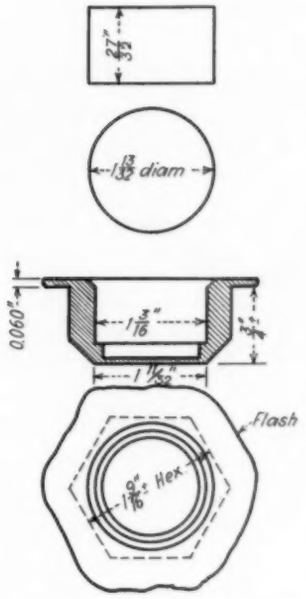
Press Work Pressures

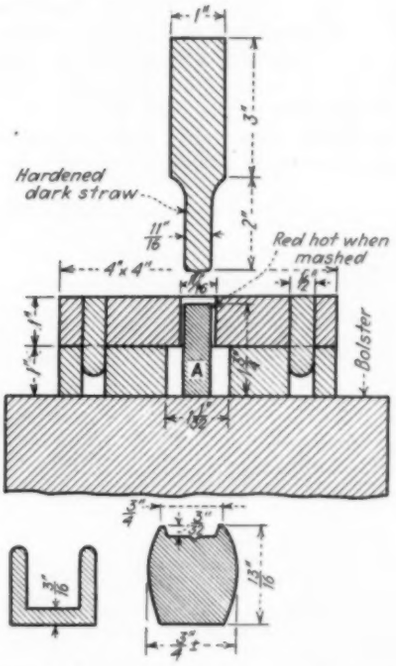
Series XVII—*Forging*



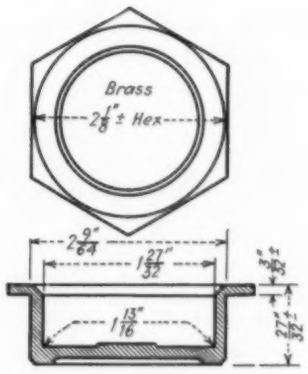
Material--Annealed brass, slug 1-3/32 in. long by 3/8 in. in diameter
Operation--Forge cold
Pressure--A. 70,000 lb. B. 100,000 lb. C. 200,000 lb. D. 300,000 lb.
Test made in testing machine



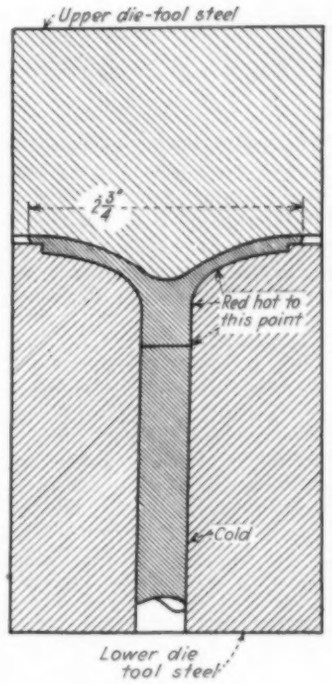
Material--Brass blank 1-13/32 in. in diameter by 27/32 in. thick
Operation--Forge hot
Pressure--250 tons



Material--Machine steel, 5/8 in. in diameter by 1-3/4 in. long
Operation--Forge a steel shrapnel case
Pressure--60 tons



Material--Round brass blank, 17/16 in. thick, 2-1/16 in. in diameter
Operation--Forge hot
Pressure--400 tons



Material--Copper strips, 1/2 by 1/2 in. by 1 in. long
Operation--Forge red hot
Pressure--250 tons

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• IDEAS FROM PRACTICAL MEN

Milling in Two Planes

MATTHEW HARRIS

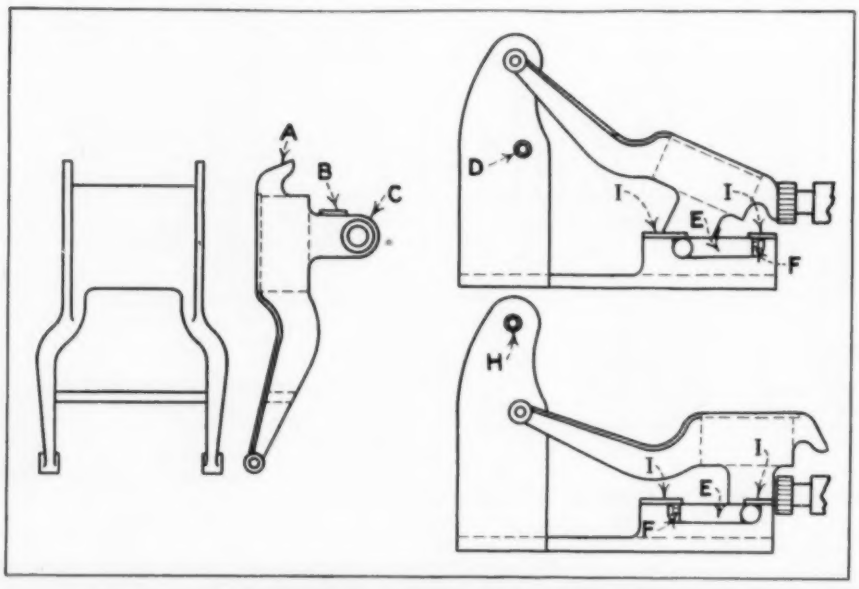
In machining the beds for printing presses of the job type, one of the particular points is to get the angular surfaces *A* of the tracks for the ink rollers in correct relation to the seats *B* for the feet of the brackets of the ink disks. The plane of the ink disk is at an angle of about 5 deg. greater than that of the angular surfaces of the roller tracks, the function of which is to guide the ink rollers into gradual contact with the ing disk without striking its lower edge.

This job always gave more or less trouble on the erecting floor. Sometimes the disks were too high and the bosses of the disk brackets had to be faced off slightly. At other times the angular surfaces of the roller tracks projected too far above the disks and had to be filed down. To get these two surfaces in correct relation, we made the fixture illustrated.

A shaft was put through the holes in the lugs *C* at the back of the bed and the bed was placed in the fixture as shown in the lower view. Locating pins were put through holes in the feet and into the bushed holes *D* in the uprights. The ends of the shaft were thus brought into contact with the stops at the right. Blocks *E* were placed behind the ends of the shaft and were tightened by means of jackscrews *F*. The cutter was set to a hardened block (not shown). In this position, the seats for the feet of the disk bracket were milled. For milling the angular surfaces *A* of the roller tracks, the blocks *E* were removed and the locating pins were withdrawn from the holes in the uprights. The feet of the bed were then raised, the bed slid to the left, and the locating pins entered in the holes *H* in the uprights. The blocks *E* were put in ahead of the shaft ends and the jackscrews were tightened, the position of the bed being as shown in the upper view.

In this position, the angular surfaces of the roller tracks were brought into the same plane occupied by the seats for the disk bracket in the first position, and in correct relation thereto. While the cutter needs no horizontal adjustment, it had to be raised vertically about 4 in. To avoid both raising and lowering the cutter for each successive bed, the operations on the next bed were to first mill the angular surfaces of the roller tracks and then to place the bed in position for milling the seats for the feet of the disk bracket, as in the lower view. By thus alternating the sequence of operations it was necessary to raise or lower the cutter once only for each bed.

While the beds were heavy enough to need no clamping, as a precaution against their being lifted up under pressure of the cut, pieces *I* were attached to the tops of the end stops for the ends of the shaft to slide under. The faces of the stops and the bottoms of the slots were protected from undue wear by inserts of hardened steel.



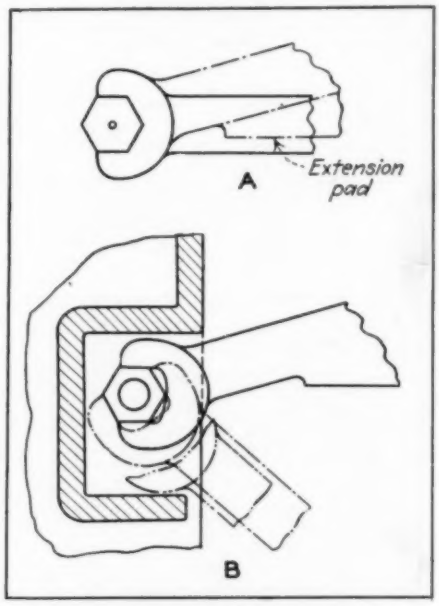
This simple milling fixture insures proper relation between two surfaces which controlled the inking of type in a printing press

A Little Kink for Designers

HENRY W. BOEHLY

In designing machinery it sometimes happens that studs or bolts have to be put in places where there is but little room to work a wrench in tightening or loosening the nuts.

For finding the wrench clearance, much time can be saved by making a set of templets of standard wrenches of various sizes and types. The templets, one of which is shown at *A*, may be made of thin sheet brass and there should be a very small hole corresponding with the center of the bolt, about



A convenient templet for use by designers in allowing room for turning open-end wrenches

which the templet can be swung in checking the clearance. A templet for the type of wrench at *A* should have an extension pad on its handle to serve as a guide in checking the clearance.

The illustration at *B* is intended only to give a general idea of the simple use of the templet. In practice, several types of wrenches may be used on the same nut, and it is a great advantage to have a set of templets at hand. While the cost of the templets will add some-

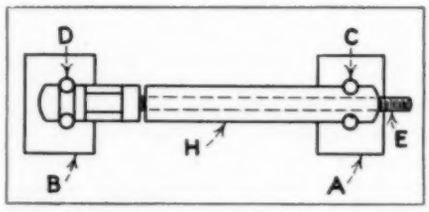
what to the cost of the drawings, it must be agreed that the cost will soon be absorbed by saving in time where tight places for bolts or studs frequently occur in drawings.

A Compound Sine Plate
Discussion

JOHN E. HYLER

The compound sine plate described by Henry W. Boehly (*AM*—Vol. 77, page 540) seems to be a very good one. However it has one feature that I believe can be improved upon. I have reference to the right- and left-hand threaded hook bolts for locking the plates together at any given angle to which they have been set. It is obvious that the nut *L* must be threaded right- and left-hand, each thread extending as nearly to the center as is possible. The scope of such a nut would be so small as to necessitate keeping at hand a quantity of hook bolts of various lengths. These hook bolts, like all other small devices, have a habit of disappearing when most wanted, and even if this were not so, they would be more or less trouble in use.

Referring to the illustration of a substitute device, the two small plates *A* and *B* are swivelly mounted on the upper and the lower sine plates by means of center pins (not shown). Each small plate carries two studs at *C* and *D* extending outwardly. The expanding and contracting member consists of the special screw *E* and the long nut *H*. The head of the screw is provided with a hexagonal portion on which a wrench can be used, and with a semicircular groove to engage the two studs *D*. When the screw is turned, the head is free to turn between the studs *D* because of the groove. With reference to the long nut *H*, instead of a groove there are two semicircular seats milled across it in parallel. Thus, while the nut is retained by the studs, it is prevented from turning. Therefore, turning the screw will either push the sine plates farther apart or draw them closer together, depending upon which way it is turned.



Combination sine plates can be held in adjustment by this device

If the studs are very slightly converging as they protrude from the small plates, they will hold the device in place without further fastening. However, should the device tend to slip from between the studs, the ends of the studs can be drilled and tapped and a light retaining link can be attached across them with screws. One small plate should be mounted as near to the top of the lower sine plate and the other should be mounted as near to the bottom of the upper sine plate as is possible. The greater the length the screw and the nut can be made without interference, the greater will be the adjustment scope of the device.

A Fixture for Fragile Castings

F. SERVER

Parts that will do the necessary work when assembled in a machine do not always have to be rigid enough to withstand the stress of machining if they are properly supported. Such a part is shown in Fig. 1 in the main view.

The surface *A*, the top of lug *B* and the four bosses *D* are to be finished by grinding. A plan view of the holding fixture is shown in Fig. 2. The locating points, the supports and the method of clamping are all indicated. In the upper left-hand corner of Fig. 1 are two views of the side clamp for holding the end *A* and at the upper center are two views of the clamp for holding the part *C*. With the work set in the fixture, Fig. 2, for grinding, it rests on the finished surfaces *F* and *H* and on the fixed pin *I*, forming three locating points. Endwise, the curved part is forced diagonally against the two pins *K* by a knurled thumbscrew, and the lug *B* is set against the side plate *L*, having an elongated hole for its screw.

To hold the end *A*, the spring block *M* is allowed to come naturally against the side of the work and is clamped in that position. At the opposite side, a block is forced against the work by a screw. The spring pin *N*, having a compression spring below and a clamping screw at the side to lock it, completes the support of the end *A*. Another spring pin *O* of the same type supports the work at the center. As an additional means of securing the work, the clamp *P* holds down the center of

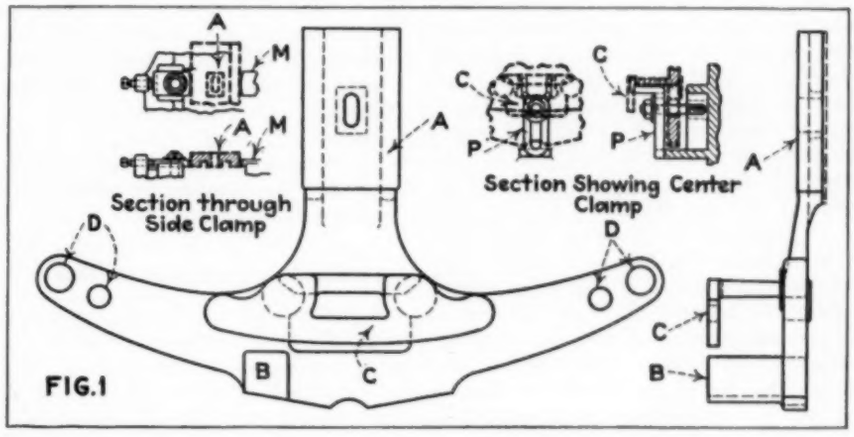


Fig. 1—Details of the light casting which had to be held firmly to resist the stresses imposed while machining but without springing the work

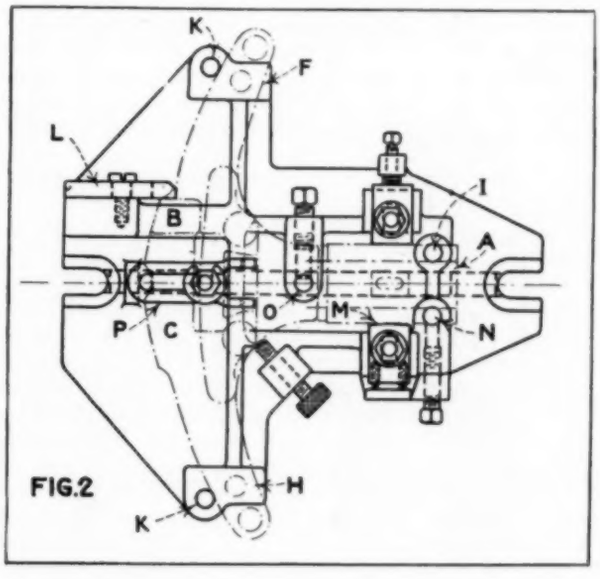


Fig. 2—Grinding fixture designed not only to position the work accurately but to clamp it at points that will avoid distortion when released

the curved portion. The grinding is done by a wheel in a vertical spindle.

After the grinding has been finished on this side, it is a simple matter to locate the work with the opposite side uppermost by the finished points *A* and *C* in another fixture. In this second fixture, the pads and the bosses indicated by finish marks are ground. By the means described, the work was finished without any tendency to spring it out of shape. No attempt was made to hurry the job, the main consideration being given to the accuracy of the work.

Scribing Circles at Planes Differing from the Centers

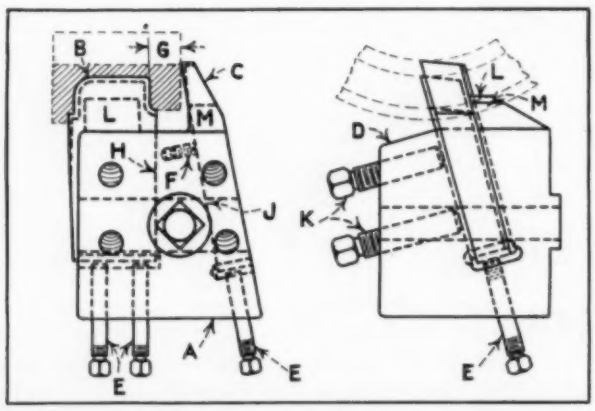
C. W. PUTNAM

We had a lot of castings on which it was necessary to lay out circles for bolt holes, the centers for the dividers being on different planes from those on which the circles were to be scribed. The usual custom was to find the correct amount to open the dividers by trial and error.

Deciding that there must be some way to find the correct amount to open the dividers at the start, I designed the device illustrated. It consists of a base so arranged that two combination-square blades are held at a right angle to each other, the adjacent ends of the blades resting on opposite sides of a pointed locating pin.

To illustrate the working of the device, a flanged casting is shown at the left, in which a circle 11¼ in. in diameter is to be scribed from the center of the hub onto the flange, the plane of which is lower than that of the hub face. One leg of the dividers is placed at 5⅝ in. on the horizontal scale and the other leg is placed on the vertical scale at the height of the hub face of the surface to be scribed, which in this case is 2¼ in. With the dividers so set, a circle of 11¼ in. diameter can be scribed on the flange.

Seeing this device, the foreman of the pattern shop had several of them made for his men, as they were up against the same problem at times.



Device for setting dividers to scribe circles at different planes from the centers

SEEN AND HEARD

JOHN R. GODFREY

Something New in Flames

An entirely new flame, known as the diffusion flame, has been devised for forging operations. Described at the convention of the American Gas Association by Henry O. Loebell, vice-president of the Combustion Utilities Company, this new burning method provides alternate layers of gas and air slowly flowing through a furnace so that combustion takes place only at the zones where air and gas meet.

When in operation, an unburned gas blanket flows over the heated steel, preventing it from forming scale. Thus passes another picturesque phase of forging. No longer will the sparks fly as the hammer shapes the work.

Eye-arresting as this display always was, it represented an economic waste. The surface of the steel pitted and the life of shaping and forming dies was reduced. With the gas-protected forge a new standard of efficiency has been set up.

Another advantage claimed for the diffusion flame is that it enables work to be heated to the forging temperature at unheard-of speeds.

Cylinder Bores Once More

Reports from European automotive shops tell us that the single point cutter is coming back into its own. The question of lubrication has bobbed up again and they have decided that ground or honed cylinders are not so good, not having enough places to hold oil for piston lubrication. So they have a new boring method where a keen single-point cutter, with a feed of about 0.008 in. wends it way through one bore in about 4 minutes or 32 minutes for an 8-cylinder block, not counting the shifting from bore to bore. This fine thread, which can just be felt with the finger nail, holds oil for the piston and reduces friction with its attendant wear, at least until the ridges wear down. Honing experts tell us that the minute scratches left by the hone with the outline of a figure eight, hold all the oil necessary. And some of the modern cylinders give exceptionally long mileage. But just as differences of opinion are behind all horse races, so different ideas prod us into trying new methods or to the revamping of old ones. Who's next?

Bearing Metals and Pressures

There's a lot of misinformation afloat about bearings as well as most other things. One of these is that hardened steel surfaces will not run together. The one weak spot in the statement is that it isn't so. For there are machine tools in operation in which two hardened sliding surfaces run together. And hardened spindles is hardened bearings have been run for years, especially in small grinding spindles and precision tools. The main requirement seems to be that they be really hard. We still have a lot to learn about bearing surfaces and bearing pressures. When it comes to heavy bearing pressures we look to locomotives and similar machinery. But the heaviest pressures I know of, per square inch, are to be found in the watch-like jewel bearings in electric meters and similar mechanism. It is almost unbelievable, but the pressure runs up into tons per square inch. The answer is that the bearing surface has practically no area!

Rest Cure for Worn Gages

We all know how cast iron grows when heated—and perhaps from age alone. But with our modern steels and methods of aging when used for gages, growth seldom cuts much of a figure. In a well known plant the other day the man who passes on the accuracy of gages, tools and fixtures showed me some worn plug gages that had taken a new lease of life. They had been discarded a couple of years before as being too small and dropped into the "hell box" for disposal. For no special reason he had measured one of these gages and found that the rest cure had brought it back to size. Checking a few others he found that several of them were usable once more, and don't think he didn't know how to measure gages! His air conditioned room is kept at 68 deg. F., and his instruments measure to hundred thousandths.

THE ROUND TABLE

The Buyer

"Hellow, Al; I hear you're looking for a purchasing agent. That so?"

"Not in the sense you mean. I am on the lookout for some bright young fellow that has been an assistant. I want some one who still has something to learn."

"How come you want anybody? You don't want a cost clerk, or an inspector, seems to me that a buyer is more useless."

"I don't want a buyer, I can do that myself, but I'm not a good purchasing agent. I always buy on the highest price, because I think the stuff must be better if it costs more. I am not enough of an engineer to know how much safety factor I need, and our compressor is too heavy and costs more than it should for material."

"What you're looking for is a combined engineer, chemist and metallurgist with purchasing as a side line, eh?"

"Just about it, Ed, but I am only going to hire the purchasing agent and let him finally wake up to the fact that he's inspector, chemist and stores keeper."

"What do you mean, stores keeper?"

"Oh, this is going to be a new kind of purchasing department. Instead of just placing orders, and then forgetting about them until some one steps on his tail and yells for material, I am going to consider a purchase not made until the material is in rough stores, tested, inspected and ready to serve out."

"Well, that's what we do now, isn't it?"

"Yes and no. Material isn't in, of course, until it's in stores, but I'm going to make the purchasing agent responsible for rough stores."

"You might as well hire a good man for stores and one for buyer, because you'll have to give the buyer an assistant if he's going to watch the storeroom too."

"I don't think so, Ed, I'm merely going to enlarge his horizon a little and change his objective. Purchasing agents usually get in their bids, place their orders and then heave a sigh of relief and sit back until time to place more orders. I'm going to make mine think about the serving window in rough stores, every time he places an order. I figure it will save time and jaw bone."

"All right, old top, but I predict you won't find a man willing to take both jobs for the price of one, and if you do, he'll be in the bughouse in six months."

"Maybe I won't find the man I'm looking for, but if I do, you bet I'll take care of him. I agree that the usual method of rushing material would make a man bughouse, and for that reason no one will rush material. When a man goes to rough stores and asks for material he's done. The only way the foreman can rush it is through me, and I'm not going to."

"Foreman? You got a foreman now, Al?"

"Yes, we have had for some little time. We have some large orders for air conditioning people, and we are stocking a number of sizes. We're expanding rapidly."

"And you're finding that management is getting more complicated?"

"It's just as complicated as you want to make it; no more. The more hands an order has to go through the longer it takes to get material. The more people that have to look at and inspect material in process the longer it takes to go through. You can't have straight line manufacture and route parts to an entirely different department. I'm going to have orders and material follow the line of least resistance. From source of origin to and including rough stores is the first step. After that it belongs to the shop. That's my idea of straight line manufacture. No stops, no confusion."

Does the duty of the purchasing agent end with placing orders or when satisfactory material is in stores? Is Al right in putting the storeroom under the purchasing agent?

Discussion

A Better Shop

An honest workman expects to give a fair day's work for fair pay with reasonable hours in a clean, light shop having plenty of fresh air, good drinking water and good sanitary conditions. He also expects to be treated with the respect due a man who knows his trade. Most men look upon these points as fundamental essentials of a good job. Without them, any so-called welfare projects savor of insincerity.

The management of even a small shop can help its men by extending to them the advantages of obtaining discounts through greater purchasing power and by giving them assistance in banking or legal problems. Allowing the use of waste space for recreational purpose, from horseshoes to tennis, makes for contentment. That management is successful with men that says in deeds rather than in words, "We believe that you are men with pride, independence and skill. If we didn't we wouldn't keep you. Therefore, we are trying to treat you like men. We expect from

you in return, respect for our authority, and cooperation in making this shop successful to the benefit of us both."

—Harrison G. Brown,
Supervisor of Standards,
Crompton & Knowles Loom Works

One Channel?

I have read with interest the discussion on the above subject by C. F. Staples (*AM*—Vol. 77, page 404g) and wish to take exception to some of his views.

Regarding credit: If a small concern is enterprising enough to obtain a large volume of business and thereby increase its purchasing requirements, credit can readily be obtained to finance unfilled orders on hand. It is safe to assume that in selecting a supply house with which to deal exclusively, the concern has wisely chosen the most progressive house in town, and one whose credit has never been assailed.

Regarding price: The supply house that has been favored with a concern's confidence will make a real effort to justify that confidence, and will offer as favorable, if not more favorable prices than can be secured elsewhere. Shipping costs will not be increased, as Mr. Staples contends, since the manufacturer will ship the goods to the consumer direct and bill the supply house.

Regarding salesmen's opinion: Any salesman who becomes disgruntled and speaks negatively of any concern or individual soon gains for himself an unenviable and unsavory reputation among the trade. —Ira S. Williams.

Keeping Time

In a small shop manufacturing a standard article, such as compressors, Al can get by without a cost and time clerk providing he sets up some other method for checking the time spent on various operations. The main function of a time and cost clerk is to act as a check on the time spent on different operations, and this can be taken care of by the manager of a small shop providing he makes it his business to check the men periodically and to let them know that he is checking their time.

There is no doubt in my mind but that the different bonus and piecework systems have been adapted to protect the company against excessive lost time and to cover weaknesses and failings of untrained executives. It is comparatively easy for an executive to learn the number of units that can be produced during a given number of man-hours and then by a count determine whether or not his employees have been efficient.

—C. Staples.

Doing Without

The argument between Al and Ed hinges upon the difference between an inspection function and an inspection department. Al can not avoid the former, but he can avoid the latter. The responsibility for a satisfactory inspection function is squarely up to Al, who with his foreman's help, can make it work.

Having gone through the earlier development stages of the compressor with Al, his foreman has an accurate knowledge of the requirements of the several components. From the troubles encountered and cured, Al, his foreman and the assembler know where the sore spots are likely to be, so that if the foreman is fair minded, he is qualified to act as a part-time inspector.

If Al does his part in providing proper backing, proper facilities and proper people, he can have adequate inspection without a formal inspection department for some time to come. As the plant grows in size, the general scheme of the foreman acting as inspector can still be satisfactory until the volume is such as to warrant the installation of a full-fledged inspection department.

—Roland V. Hutchinson.

Thirty-Hour Week

The general case for and against the 30-hour week needs consideration from two points of view: whether the job is that of watching something or of doing something. If all a man has to do is to watch a machine, or at most perform operations which are timed by the machine, as for example, feeding a punch press, then short hours for the man mean short hours for the machine and increased cost of production because overhead charges do not decrease with hours of operation.

If the worker labors with hand or

brain we may safely say that in most cases a man can do all that it is good for him to do in 30 hours. Of course there are "iron men" who work all sorts of hours for years, but they usually break up enough earlier in life to make up for their intemperance. Then there are men so sluggish of mind that they cannot speed up but must work at their own pace. But for the great number of us the amount of physical or mental labor that we did when the week was 60 hours can just as well be packed into 30, perhaps less.

From this it appears that the short week is more of a handicap to the machine than to the man. To those who fear that the machine is a Frankenstein monster, this will be a relief, but not for long. There is no doubt but that among the readers of the *American Machinist* there are men who will gladly undertake, given sufficient capital, to design machines that will so far eclipse in labor-saving, anything in the past that they will make present machines look like the proverbial 30 cents.

—E. H. Fish.

That the 30-hour week will come just as did the 48-hour week is clear to everyone who studies the industrial history of the civilized world. If Al makes up his mind to get all his work done in the 30-hour week by having two shifts, he will find that it can be accomplished. Also, he will find a superintendent who will turn out the work to his fullest satisfaction while he is absent. He will not have to lose any sleep as far as either production or quality of the work are concerned. There would be no errors to correct when he came back.

If Al reorganizes before he is compelled to by the natural course of competition, he will be just so much ahead of the times. Many will agree with Ed that if one is told to do a thing, he will find a way to do it.

So far as knowing how to spend the extra hours of leisure, that will cause little difficulty when prosperity returns.

—Henry W. Boehly.

There seems to be a nation-wide agreement that the shorter working week is an intelligent method of spreading employment. No one can doubt that it is for the greatest good of the greatest number and will hasten the progress of industrial recovery.

So Al might as well climb onto the band wagon and give up the idea of hindering the progress of this evolution he talks about. His objection to the shorter working week is that he will have to run two shifts and will not be able to supervise them both. In his own mind, without his guiding hand, the business will go to rack and ruin. In reality, Al could make the two-shift arrangement successful by reposing a little more faith in those handpicked mechanics of his. The older hands could make up the personnel of the second shift, leaving him free to supervise and train the newer help. After all, adjustments are a necessary part of evolution. —Robert S. Alexander.

SHOP EQUIPMENT NEWS

Fay 8-In. Automatic Lathe

The Jones & Lamson Machine Co., Springfield, Vt., is now offering the 8-in. Fay automatic lathe—a light, flexible, universal machine completely automatic in its cycle. This small size Fay automatic may be used for machining washing machine and refrigerator parts, valves, valve stems and bushings, small shafts similar to those used in automobile starters and generators, small pistons and similar parts. It is also adapted for light finishing operations on larger work such as automobile transmission shafts and transmission parts.

All the tooling possibilities of the larger Fay lathes are incorporated in this 8-in. machine. Multiple tooling can be arranged on the carriage to turn various diameters straight or taper. The back arm is arranged to face and form any number of shoulder lengths or diameters. A third cutting head, or auxiliary attachment, can be installed for turning or facing. With this combination of tool movements, a multiple tool set-up can be made on small light work the same as has been furnished on the company's larger machines.

The headstock is equipped with a built-in motor controlled by pushbuttons located on a control panel at the front of the machine. An electrical control box and the wiring are also built in. This equipment provides stop and start buttons, and also a switch that permits the spindle to be jogged with the starting button. The spindle has a flanged nose 6¼ in. in diameter with a taper pilot. It is made from a steel forging and is mounted on preloaded ball bearings. All gears are mounted on splined shafts running on ball bearings. Stopping of the machine is effected quickly by a solenoid brake built into the headstock. A wide range of spindle speeds is available through pickoff change gears. The machine is regularly furnished with three sets of speed change gears giving six spindle speeds in any one of the following four groups:

Group 1—104, 149, 208, 288, 402, 578
Group 2—149, 214, 300, 415, 578, 832
Group 3—208, 300, 418, 578, 808, 1160
Group 4—289, 415, 578, 802, 1170, 1610

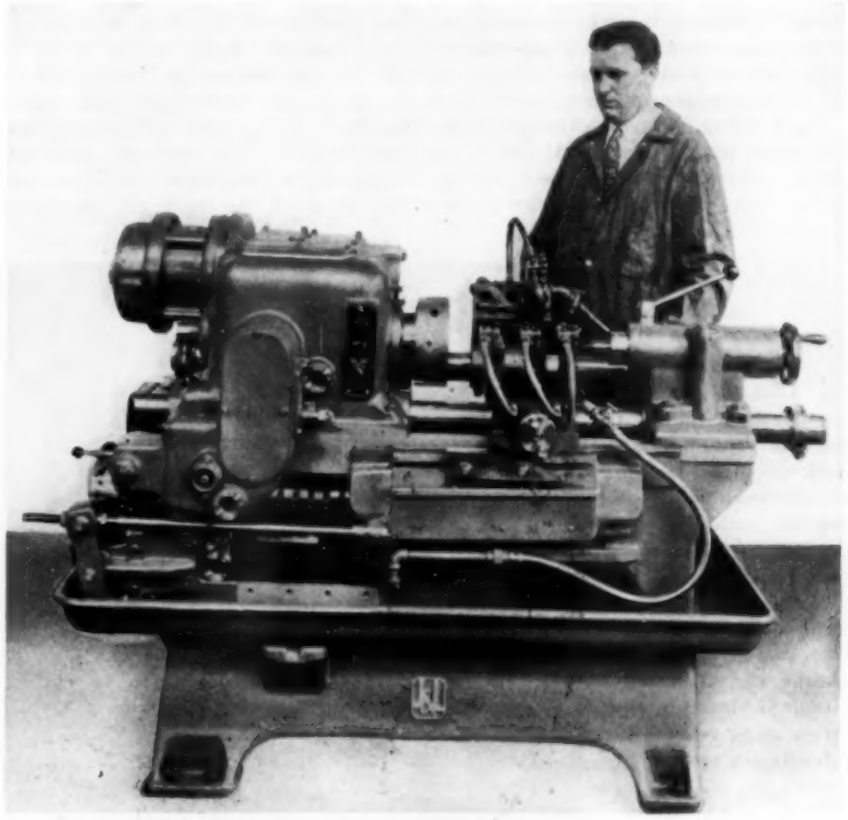
Special gears may be supplied to give higher or lower speeds.

The box-ribbed bed is arranged so that the cam drum is located under the headstock. A pressed steel pan provides ample chip room, and the base contains a large reservoir for coolant. Cams on the outside of the drum control all tool movements of the carriage, back arm and auxiliary facing attachment. A control drum, located at the end of the machine, provides means of setting for the fast and slow motion dogs and the relieving cams for the front carriage or the turning head.

Three sets of feed change pickoff gears provide six different rates of carriage feed with the standard carriage cam. These carriage feeds range from 0.004 to 0.040 in. per revolution. Special cams or special feed gears permit faster or slower feeds. Fast motion is obtained through a clutch on the back of the machine operated by dogs on the control drum. The machine is stopped by a dog on the control drum contacting with an automatic switch.

The carriage is adjustable on the center bar so that it can be positioned to suit various work. It has a cross-slide which is controlled with a leadscrew and graduated handwheel. The carriage is supported on a hardened and ground adjustable former mounted on a relieving slide so arranged that at the end of the turning cut the tools can be relieved, and thus the work is not scored on the return stroke. The return stroke is also automatic. The back arm is carried on a ground steel bar mounted in three bearings and is operated by a hardened and ground former mounted on the rear former slide. The back arm is equipped with an adjustable follower shoe so that it can be arranged for various diameters. Either a screw or lever-operated ram can be furnished in the tailstock, the ram being equipped with a ball bearing revolving center.

Standard 8-in. Fay automatic lathes are made in two lengths—8x15 in. and 8x45 in. Specifications: capacity, swing



Work much smaller than commonly done on Fay automatics is the field of this 8-in. machine, which has all the tooling possibilities and features of the larger models

over carriage, 8 in., swing over center bar, 11 in.; drive, 5-hp. motor supplied with machine; hole through spindle, 1⅝ in.; size of spindle nose, 6¼ in.; diameter of tailstock ram, 3¼ in.

Landis Air-Sizing Device for External and Internal Grinding Operations

A fully automatic device for controlling both external and internal precision grinding operations has been developed by the Landis Tool Co., Waynesboro, Pa. External surfaces may be sized readily whether they are straight, tapered, radial, splined, key-wayed or only half diameters. Internal surfaces that can be sized are straight, tapered, splined, key-wayed, interrupted or blind. The device also serves for radial internal surfaces, making it suitable for raceway grinding. Through the medium of solenoid and hydraulic valves the device can be made to control as many machine movements as necessary. It will size well within limits of 0.00025 in.

Operation of the air-sizing device is based on the principle that if air is escaping from a pressure line the pressure in the line is affected by a change of the size and shape of the outlet. This change in pressure is used to actuate the level of mercury in a U-tube in order to close contacts and to control the feeds and other machine movements.

Fig. 1 shows a typical external grinding sizing head. The work, which is placed between centers, rests lightly against two diamond points with the air outlet between the points. As grinding proceeds, the sizing head swings slightly upward, decreasing the size of the gap between the work and the outlet. Pressure slowly builds up in the air line and causes the mercury to rise in the U-tube. Before the work reaches finished size the mercury touches a contact completing an electrical circuit and energizing a solenoid which slows down the speed of the feeding-in movement.

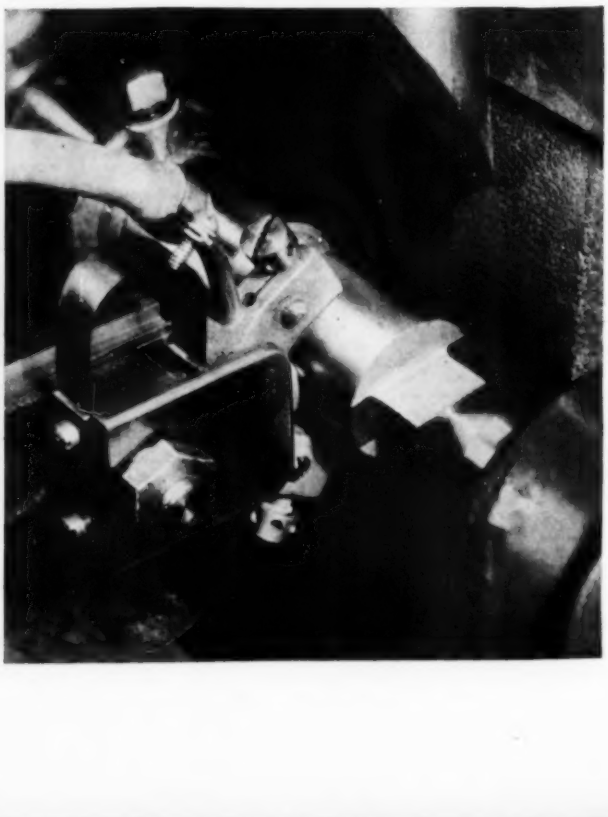


Fig. 1—Landis Air-Sizing Device applied to external grinding. The work rests lightly against two diamond points with the air outlet between the points. As grinding proceeds, the air gap gets smaller, pressure builds up in the air line, mercury rises in a U-tube, and an electrical circuit is closed to slow down or to reverse the feeding-in movement

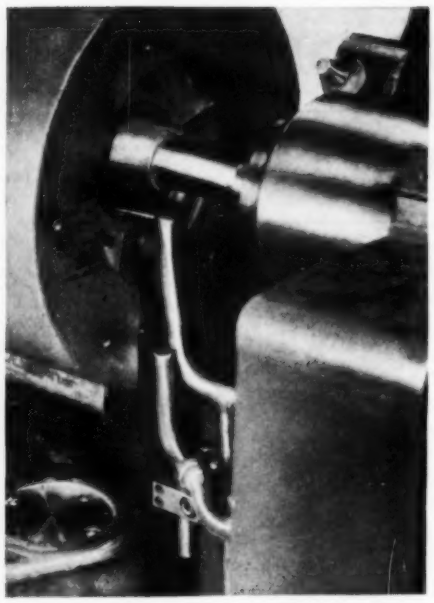


Fig. 2—For internal grinding the size of the air gap between the outlet and the work increases, pressure in the line decreases and the mercury in the U-tube again causes electrical controlling circuits to control the feed

Grinding continues until the finished size is reached, the mercury having then risen in the tube until it touches a second contact, thereby completing a second electrical circuit and energizing a second solenoid and causing the wheel to move rapidly away from the work. Should the nature of the work permit it, the wheel may be caused to feed back from the work without the addition of the slower feeding-in movement.

Fig. 2 illustrates a typical internal grinding application of the air sizing device. The tube that carries the air to the ground surface is visible below the grinding wheel. It does not come in contact with the work. In connection with some applications a second tube may be employed, as shown. As grinding proceeds the inside diameter of the hole naturally increases and along with this increase the size of the gap between the outlet and the work. Pressure in the line gradually decreases. The mercury in the U-tube functions in a manner quite similar to that described for the external device.

Setting up the air sizing device requires but a short time. All necessary readjustments are provided for. Air at from 2 to 20 lb. per sq.in. is used. Two reducing valves are inserted between the shop air line and the air sizing device. An air filter is also included.

The air sizing device is applicable only to Landis hydraulically operated grinding machines.

Geometric No. 10 Chaser Grinder and Style E Universal Chaser Grinding Fixture

With proper fixtures, the No. 10 chaser grinder developed by the Geometric Tool Co., New Haven, Conn., will sharpen any kind or make of diehead or tap chaser, milled, tapped, circular or tangent within its capacity. In addition, and because of its longitudinal, transverse and vertical travel, the machine, Fig. 1, is adaptable for other tool grinding work. When used for grinding chasers, the company recommends that the No. 10 machine be equipped both with a Style E universal grinding fixture to be described later and such chaser holders as may suit the Geometric chasers being used. Thus, the user avoids the necessity for equipping the machine with a magnetic chuck or chaser holders of his own make. The Style E universal grinding fixture is mounted on the table of the No. 10 chaser grinder. The chaser holders, one for each size chaser blank, are mounted on the fixture. So mounted the chasers can be swung under the grinding wheel

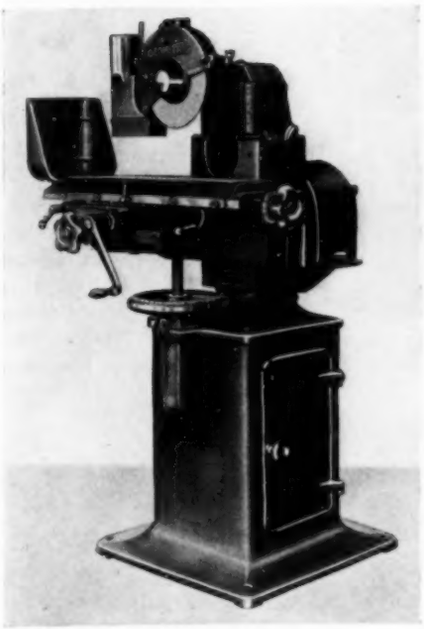


Fig. 1—Geometric No. 10 Chaser Grinder which will sharpen diehead or tap chasers, whether milled, tapped, circular or tangent

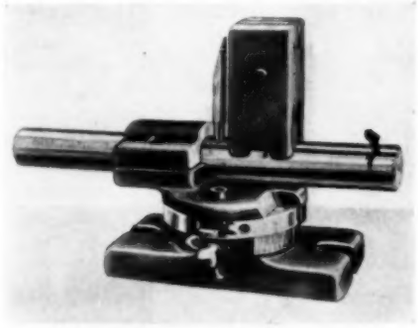


Fig. 2—Geometric Style E Chaser Grinding Fixture for grinding chasers on the chamfer and cutting face

for chamfer and face grinding to practically any angle and type of grind.

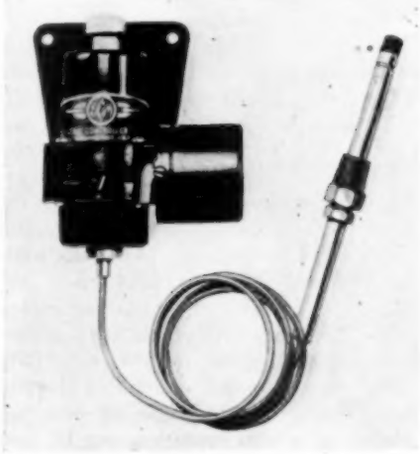
Controls on the No. 10 grinder are readily accessible. Micrometer table adjustments for fine feeds and also scales to indicate the diameter of the wheel and the vertical table travel are provided. The fully inclosed construction of the spindle keeps out dust and dirt. Micrometer feed screw dials may be set to insure even grinding on all chasers of a set. Size of the worktable is 26¾x6 in., and it has two ⅝ T-slots. Longitudinal table travel is 15 in.; the longitudinal fine feed, micrometer adjustment, 1½ in.; transverse table travel, 5¼ in.; transverse fine feeds, micrometer adjustment, 1½ in.; vertical table travel, micrometer adjustment, 9 in.; diameter of grinding wheel, 9 in.; speed of grinding wheel, 5756 surface ft. per min.; vertical clearance between wheel and table, 13½ in. maximum, 4½ in. minimum; floor space, 4 ft. 5 in. x 4 ft.; net weight, without motor, 875 lb.

The Style E universal chaser grinding fixture, Fig. 2, may be used in grinding all types of chasers on both the chamfer and the cutting face. Such chasers include milled chasers with a flat chamfer, tapped chasers with a concave chamfer, collapsing tap chasers with a convex chamfer. Both right- and left-hand chasers may be sharpened. Besides its use on the No. 10 chaser grinder this fixture can be used on any universal surface or similar grinding machine. To grind tapped diehead chasers and collapsing tap chasers, the machine should have longitudinal and vertical adjustments, whereas to grind milled chasers the machine should have longitudinal, transverse and vertical adjustments.

The Style E fixture has improvements over the older type (*AM*—Vol. 71, p. 517). For example, an additional plate has been added which permits the fixture to be offset, thus giving the proper chamfer clearance for tapped (hobbed) diehead chasers or collapsing tap chasers. This offset plate is equipped with opposing adjusting screws so that fine adjustment may be made and then the whole locked solidly in place to permit duplication of grinds. The tongue and groove method of holding the holder on the fixture bar gives a more sturdy and accurate support. The fixture has readily visible scales and is furnished with one chaser holder.

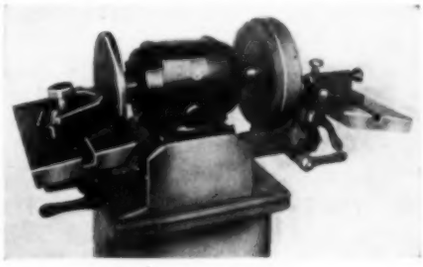
"E C & M" Bearing Thermostat

For protecting motor-driven and other types of rotating machinery from breakdowns because of overheated bearings, the Electric Controller & Mfg. Co., 2720 E. 79th St., Cleveland, Ohio, announces the Leaflet 1120 bearing thermostat. This thermostat is suited for use with motor-driven fans, conveyor systems, refrigerating machines, compressors and other units. It consists of a sealed metallic tube, containing a volatile liquid which is connected, directly or through flexible copper tubing, to a one-piece seamless metal bellows. A rise in temperature of the bearing causes the volatile liquid to expand and to generate pressure in the bulb which is in turn transmitted to the bellows and causes the contacts to open and shut down the machine. Ordinarily the thermostat operates at 100 deg. C.



"Carbide" No. 105 Tool Grinder

The Carbide Engineering Co., 356 E. Congress St., Detroit, Mich., is now offering a No. 105 grinder for sharpening tungsten and tantalum carbide tipped tools. The grinding wheel is of the ring



type, mounted on a steel plate so that the abrasive can be used completely. The diamond cutting plate is impregnated with diamond powder and produces a lapped finish on the tool. Tools used on light cuts can be resharpened regularly on this plate without any grinding operations.

Specifications: Floor space, 14x26 in.; height, to center, 39 in.; maximum clearance angle obtainable, 25 deg.; grinding wheel, 8 in. in diameter; diamond cutting plate, 8 in. in diameter, weight bench-type, 125 lb.

Electrocoated Abrasive Papers Give Better Quality Work

Certain abrasive manufacturers are now using an "electrocoating" process for making abrasive paper. The process, it is said, has made possible 60 per cent increased efficiency on some jobs, while the average improvement is from 30 to 40 per cent over the results obtained with products previously coated by sifting grain onto the fresh glue.

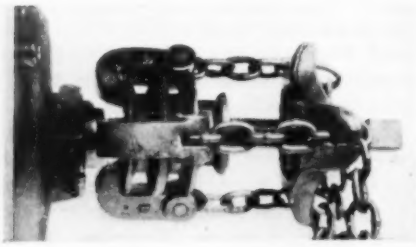
The backing, after being coated with adhesive, passes between two plate-shaped electrodes. It is positioned nearest to the upper or positive plate with

its coated side toward the negative plate. The abrasive particles are carried between the electrodes on the upper surface of an endless belt. A high tension electrostatic field is maintained. As the particles enter the field they are electrified and caused to take a position with their long axes perpendicular to the surfaces of the two belts, parallel to lines of force in the field which distributes them in an even pattern. The action of the field then propels them toward the backing strip where they are imbedded, point out, in the adhesive. As a result of this method of manufacture, the surface of the new coated abrasives presents the maximum number of cutting points to the work. The even distribution of the particles improves the quality of the work produced.

The process is being used by the Armour Sand Paper Works, Behr-Manning Corp., The Carborundum Co., and the Minnesota Mining & Manufacturing Co.

"Steelgrip" Universal Wheel and Gear Puller

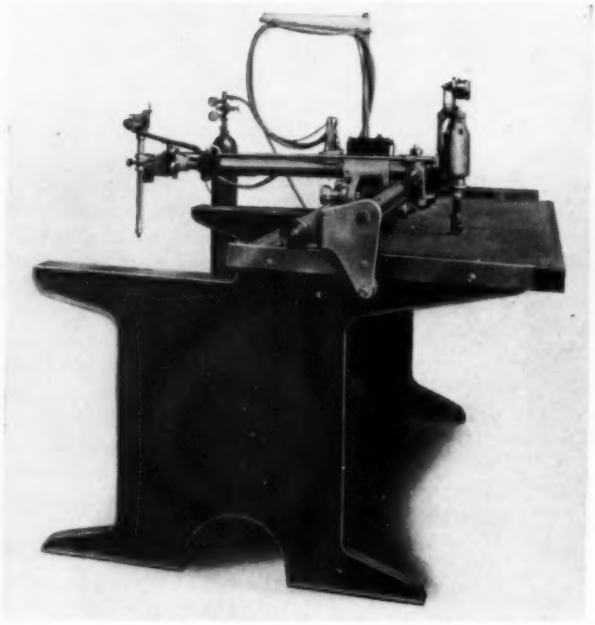
Armstrong-Bray & Co., 308 Sheldon St., Chicago, Ill., have announced a puller for wheels, pulleys, gears, bushings and pinions, known as the "Steelgrip" universal gear and wheel puller. It consists of a heavy bracket with large pulling screw and three chains of almost



any length. These chains are double ended with standard chain hooks at one end for gripping around spoked wheels or large gears and at the other end special hooks that take a close grip on bushings, small gears, motor pulleys or in close quarters. The pullers come in capacities of 12,000 and 36,000 lb.

Oxycop Toolroom-Type Flame Cutting Machine

The American Oxycop Co., Niagara Falls, N. Y., has added to its line of flame cutting machines a toolroom type for cutting large and small dies with accuracy. This machine has a cutting capacity of 24x18 in. by 8 in. thick. The machine is built under the Hancock patent and can be supplied with a burner for use with coal gas or acetylene.



Capacity of 24 by 18 in. by 8 in. thick is built into the Oxycop Toolroom Flame Cutting Machine for large and small dies

The machine is universal in application and movement because of the incorporation of three devices reproducing any design. The motor-driven head is fitted with a small tracing wheel that is used to trace the lines on a drawing. A second device consists of a small corrugated roll 1/8 in. in diameter which is held to the sides of a wood templet to assure accuracy and close cutting. A third device is the double roll that is used with a metal templet (actual size) and works automatically. A speedometer is fitted so that correct speed for cutting can be established. The arm is universally adjustable. The machine is constructed of special metal to afford strength and lightness, and ease of movement is secured with ball bearings.

A 24-in. turntable is standard on both machines but 30, 36 or 42-in. tables are available. Likewise, 24 spindles are standard equipment, but from 18 to 48 spindles may be used depending on the diameter of the turntable.

DeVilbiss Types YBA and YBB Rotary Spray Finishing Machines

Production of 1,000 to 3,600 small, light-weight articles per hour can be obtained from the Types YBA and YBB rotary spray-finishing machines developed by the DeVilbiss Co., Toledo, Ohio. The Types YBA and YBB are identical with the exception that the former is air-motor driven and the latter electric-motor driven. An automatic loading and unloading mechanism may be supplied. This may be coordinated with the conveyor system to eliminate the necessity of an operator except for occasional inspection or refilling the material tank. Either manual or automatic spray gun operation can be had.

"Bull Dog" Pipe Welding Clamp

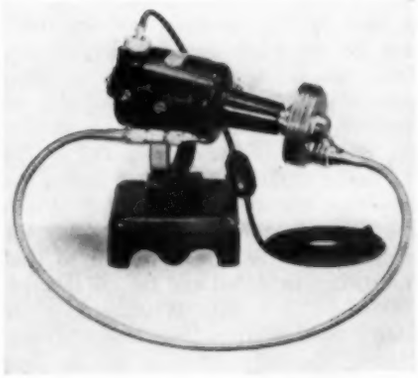
The Oster Mfg. Co. and the Williams Tool Corp., Cleveland, Ohio, have placed on the market an adjustable pipe welding clamp, the open construction of which leaves a large amount of space for tacking. At present the tool is made in two sizes, the first to take pipe from 4 to 6 in.; the second, 8 to 12 in. The lengths of pipe are automatically centered for welding and are held rigidly. One lever controls the action of the clamp. Equipped with spacers, the tool

"Bull Dog" Adjustable Pipe Welding Clamp

saves adjusting in getting the correct space between two lengths of pipe for efficient welding.

"Record" High-Speed Form Filing Machine

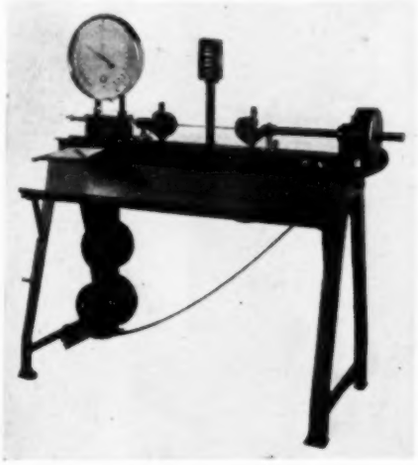
The A. K. C. Tool Co., Inc., 4219 Sullivan Ave., St. Bernard, Cincinnati, Ohio, is now building the "Record" high-speed form filing machine, which is said to operate at speeds from 50,000 to 60,000 r.p.m. with no vibration in the machine or tool. At these speeds small rotary files and grinding wheels have sufficient peripheral speed to operate at maximum efficiency. The motor is a special ¼-hp. universal type, ball bearing equipped throughout, the speed being from 8,000 to 12,000 r.p.m. The gearbox incloses two shafts and two gears, the shafts being mounted on special ball bearings. The gearbox is highly polished and fitted with radiating fins. A casing of special steel is used for the shaft and is provided with an internal arrangement for lubrication.



The core is of four strands of wire. Scarcely larger than a fountain pen, the handpiece is completely ball-bearing equipped and is of the swivel type. It has a fixed tapered collet to assure alignment of the cutting or grinding tool. The collet takes a ⅛-in. shank.

Amthor Type 275 Tensile Strength Testing Machine

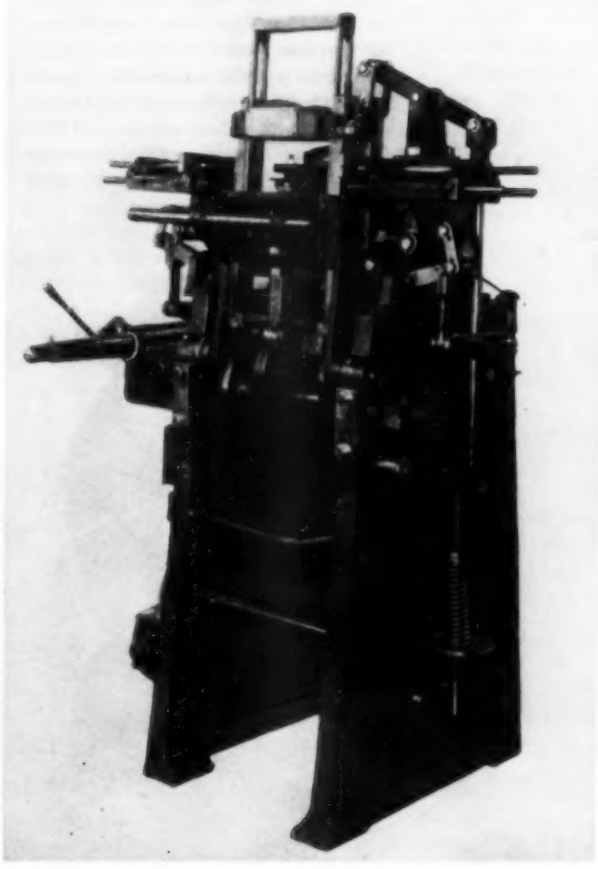
Tensile strength of cable and sheet materials can be found on the Type 275 power-driven testing machine developed by the Amthor Testing Instrument Co., Brooklyn, N. Y. This machine is of the horizontal type and operates on the pendulum principle, with automatically controlled operation. The only hand operations are to insert the specimen and push the starting button. When the specimen breaks, the tensile strength in pounds is shown on the dial. The motor and the pulling clamp stop automatically and the pendulum returns to the vertical position ready for the next test. Either an elongation indicator or an autographic recorder can be furnished, while clamps for any material are provided.



Kux-Lohner Die-Casting Machine

Lead, zinc-base and aluminum alloys are handled by the die-casting machines developed by the Kux-Lohner Machine Co., 2145 Lexington St., Chicago, Ill. The plunger method of pumping the metal into the die is used. Machines are designed to give adjustable pressure back of the plunger of 50 to 1,500 lb. per sq.in. For making castings of aluminum alloys, air pressure is used for filling the die. The core-pulling mechanism is operated by power on all six sides of the die-holder. Either a mechanical or an hydraulic core pulling mechanism can be supplied.

All adjustments of the machine are



Pressures of 50 to 1,500 lb. per sq.in. can be applied to the plunger of the Kux-Lohner Die-Casting Machine. Lead, zinc-base and aluminum alloys can be handled

in view of the operator, and any part can be set while the machine is hot. Dies can be shifted slightly to compensate for variable expansion, due to heat, after clamping in place. A squeezing device puts the two halves of the die under additional pressure during the time that the metal is being forced into the die. A stop mechanism holds the dieholder at the open position so that inserts can be added and the die cleaned.

Models "A" and "B" machines are built. Specifications for Model A machine: Capacity for dies, 9½ in. long x 6 in. high x 9 in. wide; die opening, 4¼ in.; speed of casting, 6 to 25 pieces per min.; motor required, 1 hp.; volume of metal per shot, 10 cu.in.; capacity of melting pot, 100 lb.; floor space, 4x4 ft. Specifications for Model B: Capacity for dies, 18 in. long x 10 in. wide x 10 in. deep; die opening, 8 in.; speed of casting, 2 to 7 pieces per min.; volume of metal per shot, approximately 35 cu.in.; capacity of melting pot, 500 lb. of zinc-base metal; floor space, 5x5 ft.

"Monoplex" Cut-Off Saw

By reducing vibration in its "Monoplex" cut-off saw to a negligible amount, the Red Star Products Corp., P. O. Station D, Cleveland, Ohio, is now able to offer a high-speed saw with high efficiency in cut-off operations on ferrous and non-ferrous metals. To achieve the smooth operation, the machine is built of massive construction, the precision-ground spindle revolves in preloaded SKF bearings and the rotating parts are dynamically balanced. Either abrasive disks or a special "Non-Flex Cutter" may be used on the machine.

The "Non-Flex Cutter" is a special saw developed for non-ferrous applications. This saw is either 12 or 14 in. in diameter, has large, free-cutting, ½-in. pitch teeth and runs at 4,500 to 4,700 r.p.m. Nine independent segments make up the saw. These segments are held by three means: doweling of the two bolts which pass through them; pressure on the sides brought about by the grip of the bolts, and a taper (widest at the hub) of the hub portion of the segment. The cut made with this saw is claimed to be almost polished and the burr is practically eliminated. Production cuts may be held within tolerances of plus or minus 0.002 in. Any shape, solid or tubular, which falls within a 2½ in. diameter circle may be cut on the standard machine and larger shapes on specification. Non-Flex Cutters have been tipped with tungsten carbide for cutting the more abrasive alloys. Another advantage of the segment type of cutter is the matter of heat treatment. The segments may be tempered to any degree of hardness at the cutting edge and yet the hub portion may have proper toughness.

The Monoplex saw is driven by a 7½-hp., a.c., 60-cycle, 3-phase, 220-volt motor. A pole-changing switch permits two speeds to be selected, 4,700 r.p.m. for the Non-Flex cutter and 5,500 r.p.m. for abrasive disks. The dimensions of the machine are as follows: Height, 49 in.; width, 32¾ in.; depth, 42 in. Weight, 1,175 lb.

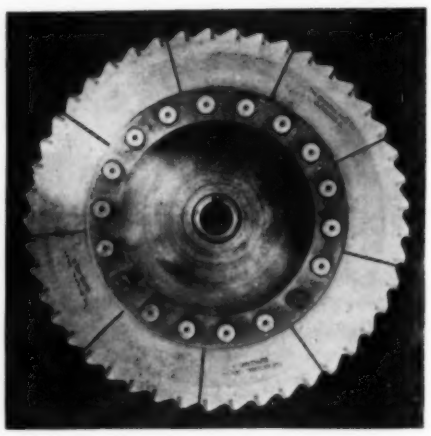


Fig. 2—"Non-Flex Cutter" to be used on the Monoplex Cut-Off saw for cutting non-ferrous materials. The segmental construction permits extreme hardness of the teeth and a tough hub portion, and the design prevents the softer metals from filling the teeth

Marquette No. H-3 Universal Engraving and Diesinking Machine

The Hisgen-Nube Machine Co., Marquette Division, 6250 Harper Ave., Chicago, Ill., has developed an improved universal engraving, diesinking and profiling machine which operates in three dimensions for cutting molds and dies of irregular shape and contour. The cavities in forming, stamping, or forging dies, as well as raised-letter nameplates, molds for synthetic plastics, embossing rolls and various other kinds of work with raised or sunken profiles, can be engraved or cut on this machine. A full-sized or enlarged model of cavity or profile to be reproduced is mounted on the tracing table and serves to guide the engraving cutter. The tracing table

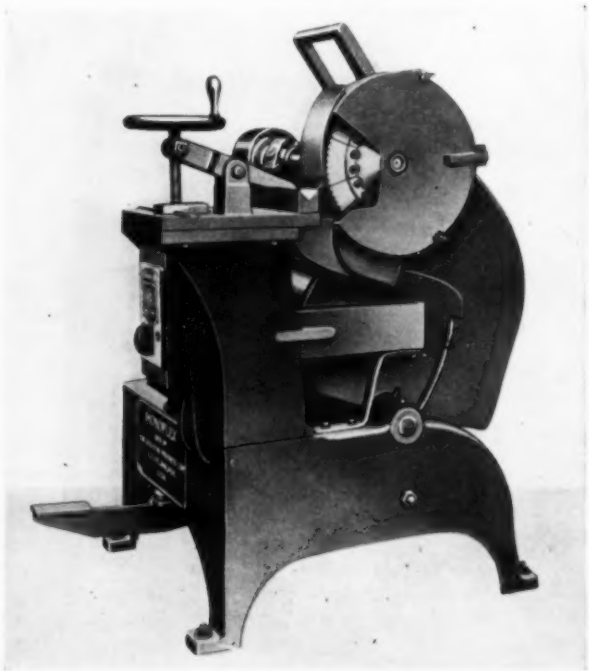
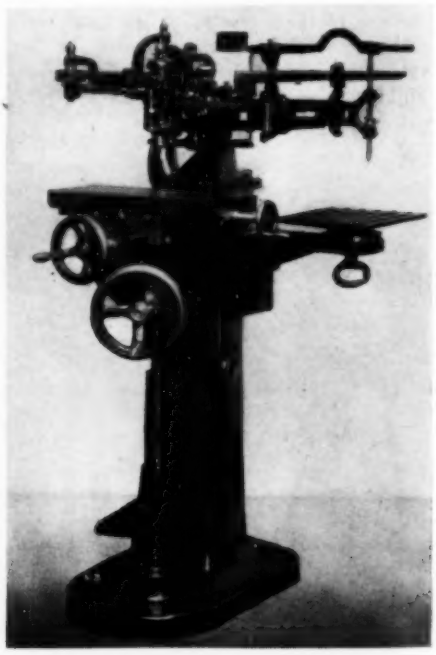


Fig. 1—Smooth cuts in ferrous and non-ferrous materials up to 2½ in. in diameter can be taken on the standard "Monoplex" Cut-Off Saw



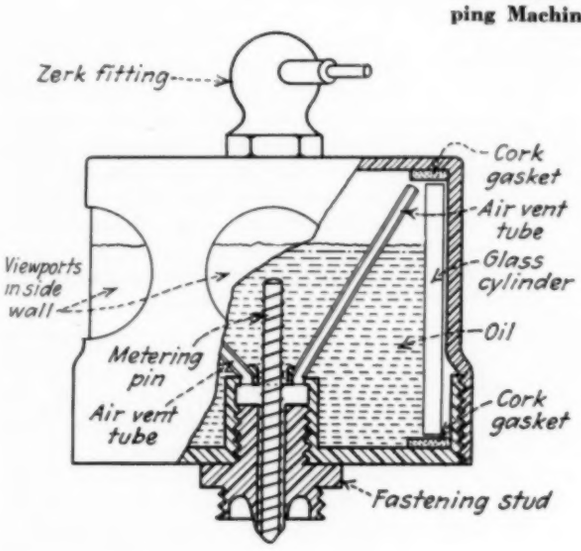
is located at the right. The dieblock to be machined is mounted on the worktable to the left. The model may be made of fairly soft material such as dental plaster or lead. A pantographic system of levers can be so adjusted that the rotating cutter will have the same movements as the point of tracer or stylus, giving a 1-1 ratio, or up to 1-10 ratio, as well as any reduction.

The two-dimensional pantograph arrangement is similar to that commonly used for flat engraving. Pivoting points are provided with precision, preloaded, double-thrust SKF ball bearings, and the engraving tool spindle runs in an adjustable split steel sleeve. Another system of levers causes the cutter to be raised and lowered vertically in synchronism with the vertical movements of the tracer or stylus.

Hallanger Industrial Oiler

Hallanger Oiler Sales, Division of National Stamping Co., 630 St. Jean Ave., Detroit, Mich., is now making an industrial oiler, claimed to give constant operation at any pre-determined feed. The patented metering pin is factory tested and adjusted so that one drop of oil per minute, or more or less, is furnished to machine bearings. Oil capacity is sufficient for a ten-hour shift, whether oils of 150 to 250 Saybolt viscosity or the lighter oils of 90 to 100 Saybolt viscosity are employed.

The oiler is made of heavy-gage steel stampings, the upper shell providing a guard for the glass. Round ports afford visibility of the supply. The steel stud and lower sight-feed container are sturdily built to minimize breaks from vibrations or blows. The air vent in the oil reservoir insures a consistent gravity feed.



Werner Gear Lapping Machine

Marburg Bros. Inc., 90 West St., New York, N. Y., are placing on the market in the United States a "Werner" four-spindle, automatic gear lapping machine that employs a triple motion principle. The machine enables four gears (two pairs) to be lapped simultaneously, each spindle carrying one gear. The upper spindles reciprocate axially whereas the lower spindles reciprocate laterally. Rotary motion of the upper spindles is secured by a gear drive. Adjustable brakes in connection with the lower spindles maintain the necessary lapping pressure between the tooth flanks in contact. The combination of rapidly alternating axial and radial reciprocating motions produces a quasi-circular path of contact between the teeth at all parts of the flanks.

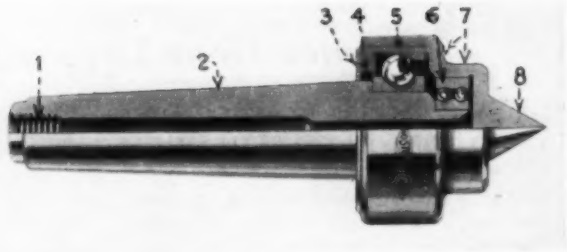
The stroke and speed of the axial and lateral reciprocating motions are adjustable to suit the requirements of the work. An electrical timing device is provided to reverse the machine, if desired, after lapping the teeth on one side. The lapping periods prior and subsequently to the reversal are adjustable separately. A pilot light indicates the continuous operation of the machine so that one attendant can operate several units. Normal, correctly cut gears require a lapping time of 5-10 min. per pair according to the number and pitch of the teeth. For flank ground gears a time of 2 min. should generally be sufficient.

Specifications: Capacity for external gears: maximum center distances of gears to be lapped, 8 in., minimum distance, 1 3/4 in.; capacity for internal gears: maximum outside diameter, 9 3/4 in., minimum pitch circle diameter of gears to be lapped with a pinion of 3 3/4 in. pitch circle diameter, 4 1/4 in.; maximum distance between upper and lower spindles, 10 1/4 in., minimum distance, 4 1/4 in.; axial adjustment of upper spindles, 0-1/2 in.; reciprocating speed of upper spindles, 800-1000 strokes per min.; radial movement of lower spindles, 0-3/8 in.; rotary speed of upper spindles, 40-230 r.p.m.; motor required, 2 hp., 1500 r.p.m.

Triple motions—rotation of upper spindles, axial reciprocation of upper spindles, radial reciprocation of lower spindles — cause even lapping action over the entire tooth flank, this principle being used in the Werner Gear Lapping Machine.

Sturdimatic Heavy-Duty Live Center

The Sturdimatic Tool Co., 5220 Third St., Detroit, Mich., has developed a heavy-duty live center in which the contact member rotates on both radial and thrust ball bearings. Normally, all of the thrust load is absorbed by the thrust bearing (5) at the rear. Under ab-



Sizes of the Sturdimatic Live Center are built for combined radial and thrust loads of 1,560 to 46,700 lb. at 100 r.p.m.

normal overload conditions, the overload is overcome by a cushioning effect developed at (7). This feature prevents any tendency to spring the work out of alignment and reduces the load on the machine's drive unit. The outer race of the radial bearing (6) is made an accurate slide fit to prevent any thrust load on this bearing. After the center has been completely assembled, the rotor nose is ground true in its own bearings. For lubrication a plug in the end of the shank (1) may be removed and an Alemite fitting substituted. At the rear end of the thrust bearing a grit and grease seal is effected by a steel ring (3) carrying a felt washer (4).

• PATENTS •

SEPTEMBER 12, 1933

Metal-Working Machinery

Work-Handling Mechanism. Daniel Kelleher, Berea, Ohio. Patent 1,926,048.

Safety Device for Multiple Grinders. Clifford T. Raule, Brookline, Pa. Patent 1,926,214.

Rotary Drum Milling Machine. Emmanuel J. Fournier, Detroit, Mich., assigned to Production Engineering Co. Patent 1,926,332.

Tailstock Clamping Mechanism. Raymond M. Woytych, Fond du Lac, Wis., assigned to Giddings & Lewis Machine Tool Co. Patent 1,926,358.

Grinding Machine. Hermon G. Weinland, Springfield, Ohio, assigned to The Safety Grinding Wheel & Machine Co. Patents 1,926,470–1,926,471–1,926,472.

Contour Surface Grinder. Carroll Knowles, West Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,926,-777.

Rotary Table Grinding Machine. William Law, Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,926,-779.

Work-Handling Apparatus for Grinding Machines and the Like. Ralph A. Quimby, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,926,-959.

Grinding Machine. Harold L. Blood, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,926,967.

Grinding Machine. Sol Einstein, Cincinnati, Ohio, assigned to The Heald Machine Co. Patent 1,926,974.

Carriage Feeding Mechanism for Lathes. William G. Hoelscher, Norwood, and George E. Hieber, Cincinnati, Ohio, assigned to The American Tool Works Co. Patent 1,926,996.

Lathe Bed Construction. William G. Hoelscher, Norwood, and Albert E. Robinson, Cincinnati, Ohio, assigned to The American Tool Works Co. Patent 1,926,997.

Grinding Machine. Joseph R. Whittles, Rockford, Ill., assigned to Mattison Machine Works. Patent 1,927,007.

Tools and Attachments

Diamond Setting and Method of Making the Same. De Nera A. Cotton, Anderson, Ind., assigned to Delco-Remy Corp. Patent 1,926,330.

Gear Cutter. James F. Leahy, Buffalo, N. Y., assigned to Farrel-Birmingham Co., Inc. Patents 1,926,645–1,926,646.

SEPTEMBER 19, 1933

Metal-Working Machinery

Screw-Cutting Machine. Harry W. Rupple, Cleveland, Ohio, assigned to The Cleveland Automatic Machine Co. Patent 1,927,419.

Machine for Rolling Sheet-Metal Shapes. Albert Rafter, Belleville, N. J., assigned to Rafter Machine Co. Patent 1,927,501.

Speed-Control Device for Grinding Machines. Albert G. Belden and Frank E. Drown, Worcester, Mass., assigned to Norton Co. Patent 1,927,655.

SEPTEMBER 26, 1933

Metal-Working Machinery

Worm-Wheel Hobbing Machine. Edward W. Miller, Springfield, Vt., assigned to The Fellows Gear Shaper Co. Patent 1,927,946.

Grinding-Wheel Spindle Reciprocating Mechanism. Carl G. Flygare, Worcester, Mass., assigned to Norton Co. Patent 1,927,977.

Hydraulic Drive for Machine Tools. James K. Douglas, Milwaukee, Wis., assigned to The Oilgear Co. Patent 1,928,150.

Precision Grinding or Abrading Machine. Harry Hales Asbridge, Ashton-upon-Mersey, England, assigned to The Churchill Machine Tool Co., Broadheath, near Manchester, England. Patent 1,928,162.

Self-Adjusting Feed Mechanism for Machine Tools. Albert Happel, Toledo, Ohio, assigned to Kent-Owens Machine Co. Patent 1,928,489.

Tools and Attachments

Automatic Stop for Punch Presses and the Like. George H. Leland, Dayton, Ohio, assigned to The Leland Electric Co. Patent 1,928,156.

Cutter Head for Boring Machines. Thor Thorsen, Minneapolis, Minn., assigned to Storm Manufacturing Co., Inc. Patent 1,928,514.

• TRADE PUBLICATIONS •

OPTICAL INSTRUMENTS. The Bausch & Lomb Optical Co., Rochester, N. Y., has published "Optical Instruments for the Metal Working Industries," in which are described such equipment as the contour measuring projector, the toolmakers' microscope, the optical drill gage, the optical protractor, the optical indexing device, the centering level, the optical comparator, optical flats, wide field binocular, inspection microscope, the shop microscope, the wide field tube or low power microscope, and the Brinell microscope. Each piece of equipment is handsomely illustrated and fully described.

ELECTROLIMIT GAGE. Many forms of the "Electrolimit" gage, made by the Pratt & Whitney Co., Hartford, Conn., are shown in a new booklet. The instrument combines mechanical gaging with electrical magnification to obtain either external or internal measurements. The publication completely describes the three units making up the gage, illustrates how it is used, and shows a number of typical applications.

STAINLESS CLAD STEEL. The Ingersoll Steel & Disc Co., Division of the Borg-Warner Corp., Chicago, Ill., has issued a folder describing applications of IngOclad stainless-clad steel for tanks, pressure vessels, autoclaves, evaporators, and indicating the use of the material in many different industries.